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CHEMICAL & Metallurgical ENGINEERING

For MARCH, 1945 • FLUORINE INDUSTRY MOLDS A POSTWAR CAREER FROM WARTIME SERVICE • SIMPLIFIED DETERMINATION OF FRICTION LOSS • PREDICTING VISCOSITY OF GASES AT HIGH PRESSURES • ECONOMIC FACTORS AFFECTING ELECTROCHEMICAL INDUSTRIES • PYROTECHNIC COMPOUNDS ATTAIN LARGE-SCALE PRODUCTION

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Published monthly. Price 35 cents per copy. Publication office, 99-129 North Broadway, Albany 1, N. Y. Address communications about subscriptions to Director of Circulation, Chem. & Met., 330 West 42nd St., New York 18, N. Y. Subscription rates: United States, Mexico, Central and South American Countries, \$3 per year, \$4 for two years, \$5 for three years. Canada \$3.50 per year, \$5 for two years, \$6 for three years (payable in Canadian funds). Great Britain and British Possessions, 30 shillings per year, 60 shillings for three years. All other countries, \$5 per year, \$10 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter September 3, 1936, at Post Office at Albany, N. Y., U.S.A., under act of March 3, 1879. Contents copyrighted, 1945 by McGraw-Hill Publishing Company, Inc. Branch offices: 320 North Michigan Avenue, Chicago 11; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Washington 4; Philadelphia 2; Cleveland 15; Detroit 26; St. Louis 8; Boston 16; Los Angeles 14; Atlanta 3; Pittsburgh 22. Return Postage Guaranteed

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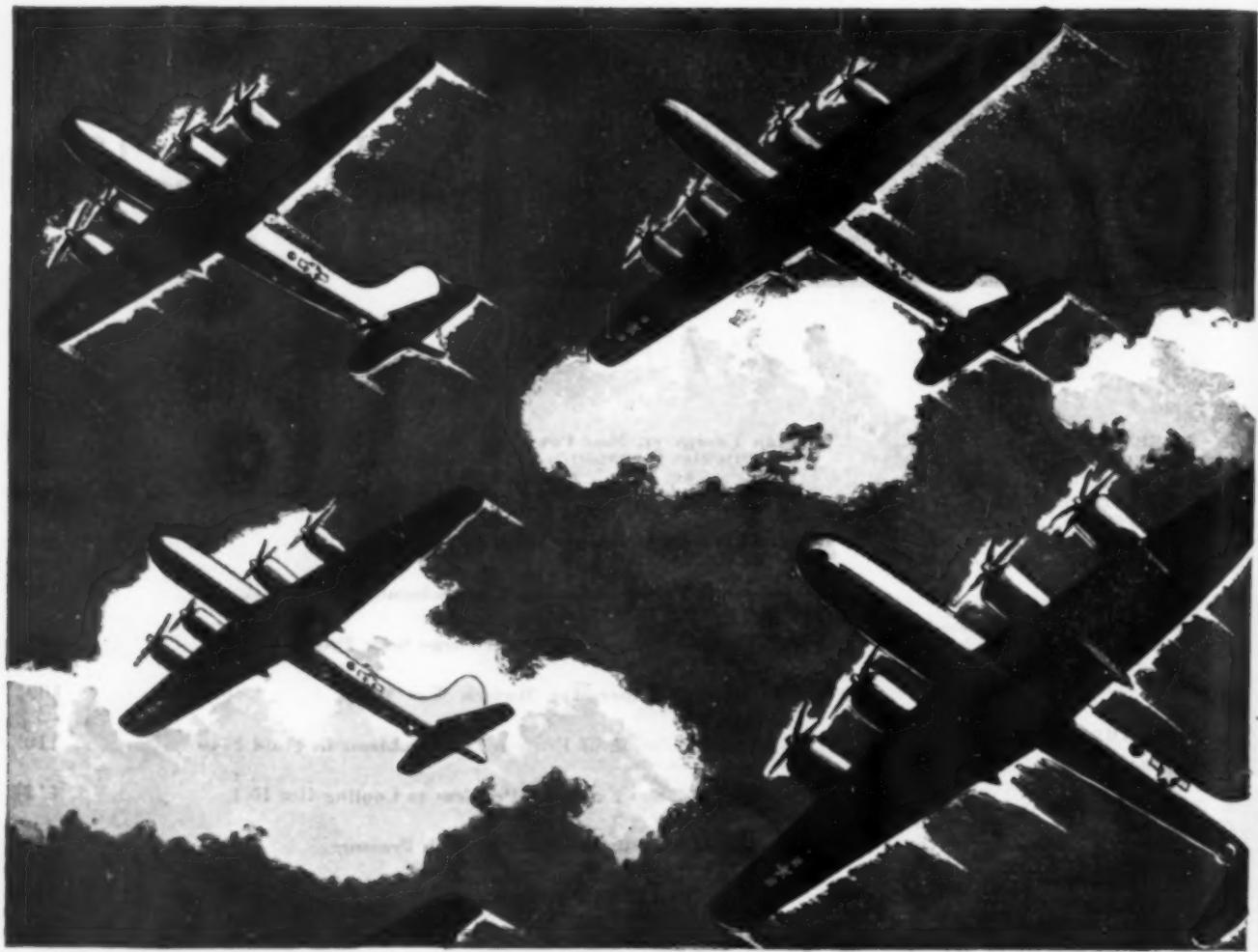
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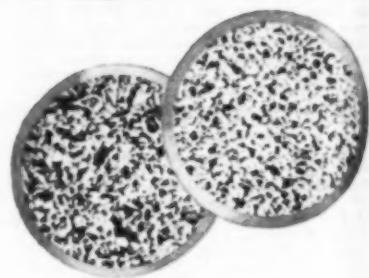
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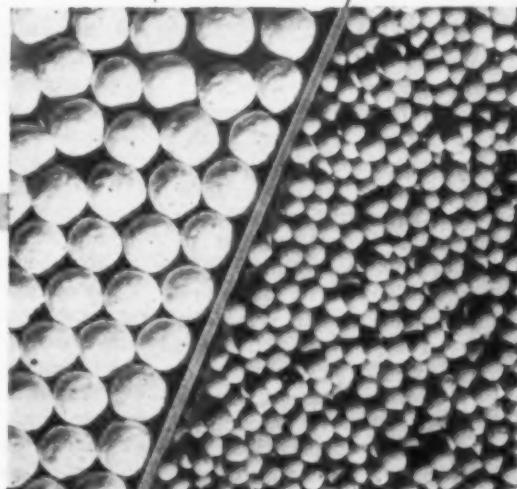


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Aluminas and Fluorides

seriously distorted the price indexes issued by the Bureau of Labor Statistics for drugs and pharmaceuticals, as well as the composite of which that index was a part, namely the wholesale price index for "chemicals and allied products." Revision has just been made and announced for both these price series which represents very large changes. For example, the drug figure for December 1944 as corrected is 106.9, as compared with the previously used figure of 217.2. The chemical and allied products change reduces the index number of the same month from 104.8 to 94.8. This change is one which has been urgently sought by Manufacturing Chemists Association for more than a year. It is necessary in using the figures to go back as far as January 1941, in order to get a corrected appraisal of trends in these fields.

NEW LIGHT METAL PLANS

Two of the government-owned magnesium plants are scheduled to render a new type of service. One is already producing calcium instead of magnesium to meet the abnormally high wartime demands for that light alkaline earth metal. Another will use its thermal reduction furnaces to make sodium. Thus the stupendous requirements for various purposes, primarily aviation gasoline anti-knock components, will be met by mid-summer without new electrolytic capacity.

WATER POLLUTION BILLS

SEVERAL senators and congressmen are again pressing bills which have as their major purpose the fixing of standards of purity and prevention of contamination of rivers and harbors. Most favored appears to be the bill which would establish in Public Health Service a unit to deal with water pollution control. That agency, if established, would prepare regulations for preventing contamination and set purity standards to be carried out under federal supervision with state cooperation. No early enactment is expected; but some developments influencing postwar controls on industry and on municipal sewage works are expected.

ALUMINUM SPEEDUP

New war demands have placed aluminum in the general class of scarce metals and brought about a 10,000,000-lb. increase in monthly production of aluminum ingot scheduled last month. The continuing need for virgin metal indicated at the beginning of March forecast the probable further increase in the number of potlines that will be returned to operation. Additional metal is needed as such and also for formula fortifications and to sweeten the scrap that is now being remelted.

Increased production announced in February was scheduled for the Aluminum Company of America plants at Massena, N. Y., Badin, N. C., and Niagara Falls, N. Y., and for the Defense Plant Corp.

plant at Spokane, Wash. Four million pounds of the increase is to come from the Alcoa operations and six million from the DPC plant at Spokane.

NEW CONSTRUCTION RETARDED

RESULTS of the first month's operation of WPB Chairman Krug's five-point program to increase war production indicates that the rigid restrictions on new construction in tight labor areas is being followed literally. (See *Chem. & Met.*, February, 1945, p. 80.) A month ago efforts to secure authorization for new plants or the expansion of old ones in No. I and No. II labor areas were getting no place. Many projects were being held up on that account. This was having an adverse effect on plans already underway.

Unfortunately, the chemical industry is located for the most part in No. I and No. II labor areas. The latest reports on the manpower situation show very little change from conditions previously reported. By the same token, there is no improvement in the program for expansion of chemical facilities.

ROSIN IS SHORT

ONE of the most difficult and annoying problems of supply now facing the Chemicals Bureau is that of rosin. It is of importance because it is the last of the natural resins available to American industry, imports having dwindled. Scarcity of labor in the woods is the root of the problem that already is acute.

Southern paper mills are competing for the same labor to cut their pulp wood and have the advantage of a higher wage scale. The paper industry has another advantage in the ballyhoo that the paper shortage has received with the result that available men have been referred to paper mills rather than to rosin producers. But now the mills which must have rosin in order to make paper are beginning to feel the pinch, like a dog biting his own tail. All elements of the industry were scheduled for a meeting at which it was hoped at least a partial solution of the problem would be found.

In the meantime, uses of wood and gum rosin have been placed under control and delivery can be made only for "preferred orders." Marine paint, food can enamel and inks for the use of Bureau of Engraving & Printing and the Government Printing Office are preferred uses.

BETTER GET ACQUAINTED

DISTRICT WPB offices are becoming more important and seem destined to remain so as long as the Army continues to take men. In most cases the WPB district manager is the chairman of the Production Urgency Committee which determines the importance of each plant in the district to the war effort. The USES must work within the PUC setup in referring men for new jobs.

It is most important for plant operators to show the district WPB manager that their product is a critical war material or a component of a critical war material. If it can be shown that a shortage in the product of a plant will impede the shooting or lead to the lengthening of the war, that plant will be in a better position to get deferment of its key employees than would otherwise be the case.

STAY OUT OF WASHINGTON

Too many chemical companies are of the opinion that their manpower problems can be solved in Washington. Result is a constant stream of visitors which is reminiscent of the early days of the war. Actually, a chemical plant can probably do at home all that Washington does in regard to the deferment of key personnel. It is necessary to show the importance of the end product to the war effort to the local committee so that that organization can take the proper action. All Washington can do is to recommend. The work, good or bad, is done in the field.

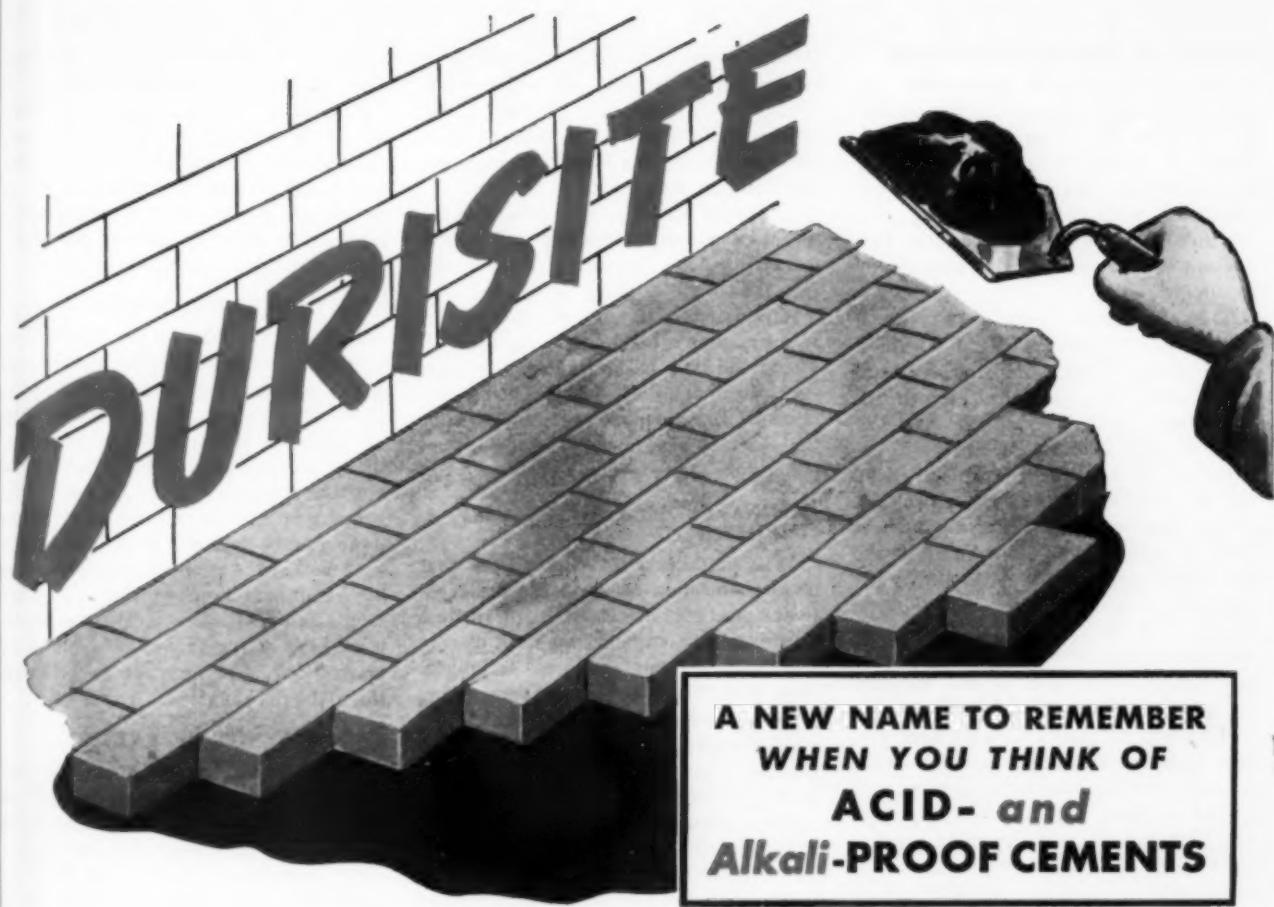
ALMOST ENOUGH FREON

RECENT relaxation of the restrictions on the use of freon indicates a better supply, but it still remains out of reach of any but the most essential uses and will continue in that condition for the duration. The bottleneck is not anhydrous hydrofluoric acid. That basic raw material is in comparatively good supply at the present time. Of course, there can be no prediction of how long that happy situation will last. The trouble with freon is in the availability of other constituents. Carbon tetrachloride is short. It in turn must compete for carbon bisulphide with rayon for tire cords and its supply also reflects the general condition of chlorine.

The easier position of freon merely means that many of the essential cooling systems that were forced to use less desirable refrigerants by the early shortage may now go back to the use of freon. Only the toughest of the restrictions have been removed and WPB cautions that nothing further need be expected.

INFORMAL CONTRACT CLAIMS

MANY firms patriotically proceeded with war business on the basis of informal, defective, or quasi contracts. Relief for such agencies was provided in the contract termination act which allows the Office of Contract Settlement to make equitable arrangements to pay firms even though they may not have a strictly enforceable contract. Firms wishing to take advantage of this are now expected to follow regulation No. 12 of the Office of Contract Settlement which defines the procedure for presenting their cases. There remains some uncertainty as to whether informal arrangements made by WPB can be so adjusted. WPB says "no"; but the Contract Settlement officer says "yes."



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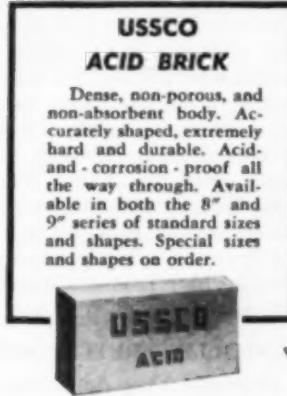
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NEW CONSTRUCTION

PROPOSED WORK

Ill., East St. Louis—General Chemical Co., East St. Louis, plans to construct and complete plant here. Estimated cost \$500,000.

Ill., Monsanto—Monsanto Chemical Co., 1700 South Second St., St. Louis, Mo., plans to construct a new sulphuric acid plant here to have a yearly capacity of 72,000 tons. Estimated cost \$700,000.

Ind., East Chicago—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., plans to construct additions to its sulphuric acid plant here. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$400,000.

Ind., Hammond—Stauffer Chemical Co., Hammond, plans to increase the capacity of its sulphuric acid plant. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$200,000.

Ind., Muncie—Ball Bros. Glass Co., Macedonia Ave. at 9th St., plans to rebuild portion of its plant recently destroyed by fire. Estimated cost \$100,000.

Mich., Detroit—American Smelting & Refining Co., Federated Metals Div., 11630 Russell St., is having plans prepared for an addition to its plant for a chlorine rack house and dress room. Cost \$70,000.

Mich., Detroit—U. S. Rubber Co., 6600 East Jefferson Ave., is having plans prepared by Lockwood Greene Engineers, Inc., 10 Rockefeller Plaza, New York 20, N. Y., for an addition to its plant here. Estimated cost \$3,000,000.

N. J., Cranford—Johnson & Johnson, 500 George St., New Brunswick, N. J., are having plans prepared by Ballinger & Son, Archts.-Engrs., 105 South 12th St., Philadelphia, Pa., for a 1 story manufacturing plant here. Estimated cost \$250,000.

N. J., Paulsboro—Socony Vacuum Oil Co., 26 Bway., New York, N. Y., plans to construct a research laboratory here. Estimated cost \$250,000.

N. Y., Deferiet—St. Regis Paper Co., 230 Park Ave., New York 17, N. Y., is having plans prepared by Charles T. Main, Inc., 201 Devonshire St., Boston, Mass., for an addition to its paper and pulp mill here. Estimated cost \$3,000,000.

Ohio, Newark—Pharos Tire & Rubber Co., Newark, is having plans prepared by Osborn Engineering Co., Engr., 2016 Euclid Ave., Cleveland, for a 3 story, 50x150 ft. mill building and boiler house. Estimated cost \$61,500.

Pa., Bridgeville—American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y., plans to alter and construct additions to its factory here. Estimated cost \$63,800.

Pa., Jeannette—Pennsylvania Rubber Co., Chambers Ave., is having plans prepared by Fletcher Thompson, Inc., Archt., 211 State St., Bridgeport, Conn., for a 1 story 175x200 ft. factory building.

	Current Projects		Cumulative 1945	
	Proposed Work	Contracts	Proposed Work	Contracts
New England.....		\$40,000		\$125,000
Middle Atlantic.....	\$3,854,000	1,280,000	\$3,854,000	1,635,000
South.....	40,000	200,000	40,000	200,000
Middle West.....	5,585,000	40,000	5,585,000	80,000
West of Mississippi.....	24,450,000		24,450,000	11,325,000
Far West.....	875,000	3,000,000	875,000	3,165,000
Canada.....	665,000	600,000	1,015,000	600,000
Total.....	\$35,469,000		\$35,819,000	\$17,130,000

Pa., Philadelphia—Abrasive Co., Tacony and Fraley Sts., plans to construct alterations to its plant. Estimated cost \$250,000.

Texas—Defense Plant Corp., Wash., D. C., plans the construction of a carbon black plant in the Pampa area. Estimated cost \$1,500,000.

Texas, Sunray—Defense Plant Corp., Wash., D. C., plans the construction of a carbon black plant in this area, to be operated by Continental Carbon Co., 295 Madison Ave., New York, N. Y. Estimated construction cost \$1,200,000.

Texas, Waco—Defense Plant Corp., Wash., D. C., plans to double the capacity of the rubber tire manufacturing plant here operated by the General Tire & Rubber Co., Akron, O. Estimated cost \$1,750,000.

Texas, Port Arthur—Jefferson Chemical Co., c/o American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y., and Texas Co., Port Arthur, plans to construct chemical plant to convert waste oils into chemicals. Estimated cost \$20,000,000.

Va., Radford—U. S. Engineer, Wash., D. C., plans to construct an addition to ordnance plant here.

Wash., Bellingham—Pacific Coast Paper Mills, Army and Chestnut Sts., plans to construct a 2 story, 95x145 ft. factory building, a 2 story, 100x240 ft. machinery building and small sheet iron building to house boiler equipment. Estimated cost \$875,000.

B. C., Vancouver—Chief Brand Oils, Ltd., 751 Grenville St., plans to construct a plant. Estimated cost \$40,000.

Ont., Bedford—Ontario Phosphate Industries, Ltd., Bedford, plans development of phosphate deposits here. Estimated cost \$75,000.

Ont., Kitchener—Dominion Rubber Co., Ltd., 145 Strange St., Kitchener, plans to construct a 137x187 ft. addition to its plant. Margison & Babcock, 137 Wellington St., W., Toronto, Archt. Estimated cost \$300,000.

Ont., Toronto—Canadian Tire Corp., 837 Yonge St., is having plans prepared for a 5 story addition to its warehouse. J. A. Thatcher, 37 Cowan Ave., Archt. Estimated cost \$200,000.

Ont., Toronto—Noxzema Chemical Co. of Canada, Ltd., c/o J. Marvin Shaw, 92 Jarvis St., contemplates the construction of a new addition to its plant. Estimated construction cost \$50,000.

CONTRACTS AWARDED

Calif., Wilmington—Union Oil Co. of California, 627 West 7th St., Los Angeles, has awarded the contract for the construction of a group of administrative buildings, including storage, shops, warehouse, storage and machine shop buildings, etc., at refinery here to McNeil Construction Co., 5860 Avalon Blvd., Los Angeles. Est. \$3,000,000.

Conn., New Haven—New Haven Pulp & Board Co., 259 East St., has awarded the contract for alterations and additions to its factory to Dwight Building Co., 152 Temple St., New Haven. Estimated cost \$40,000.

Md., Curtis Bay—Brooklyne Chemical Works, 9th and Patapsco Ave., has awarded the contract for 1 story T-shaped, 40x170 ft. and 50x70 ft. building at chemical plant to Baltimore Contractors, 711 South Central Ave., Baltimore. Estimated cost \$40,000.

N. J., Newark—Rubberset Co., 56 Ferry St., has awarded the contract for the construction of a 1 story, 50x100 ft. storage building to Vitale Bros. Co., 123 Columbia Ave. Estimated cost \$40,000.

N. J., Piscataway (Bound Brook P. O.)—Bend Products Co., Meadow Rd., has awarded the contract for a 1 story boiler house and coal silo to C. J. Schubert, 93 Ardsdale Terrace, East Orange. Estimated cost \$100,000.

Pa., Meadville—David Meade Distilling Co., Race St., has awarded the contract for alterations and additions to its alcohol producing plant to J. M. Baldwin, Whitfield Bldg., Pittsburgh. Estimated cost \$100,000.

Pa., Neville Island—Pittsburgh Coke & Chemical Co., Grant Bldg., Pittsburgh, has awarded the contract for the construction of six buildings at its chemical plant to Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost \$1,000,000.

Tenn., Clarksville—B. F. Goodrich Co., 500 South Main St., Akron, O., has awarded the contract for an addition to its plant here to Hughes-Foulkrod Co., Schaff Bldg., Philadelphia, Pa. Estimated cost \$200,000.

Wis., Appleton—Institute of Paper Chemistry, 1101 East South River St., has awarded the contract for a 1 story, 40x1160 ft. factory to Ben B. Gauthier Co., 78 State St., Oshkosh.

Ont., Hamilton—Firestone Tire & Rubber Co. of Canada, Ltd., Beach Rd., has awarded the contract for an addition to its plant to Phil Construction Co., Ltd., 126 King St. E., Hamilton. Estimated cost including equipment \$600,000.

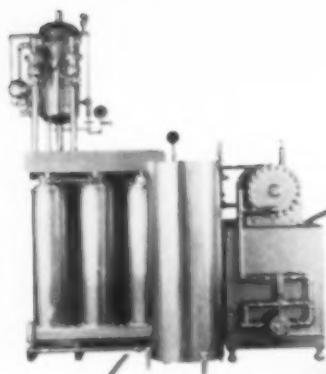
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Variations upon a theme



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Published monthly. Price 35 cents per copy. Publication office, 99-129 North Broadway, Albany 1, N. Y. Address communications about subscriptions to Director of Circulation, Chem. & Met., 330 West 42nd St., New York 18, N. Y. Subscription rates: United States, Mexico, Central and South American Countries, \$3 per year, \$4 for two years, \$5 for three years. Canada \$3.50 per year, \$5 for two years, \$6 for three years (payable in Canadian funds). Great Britain and British Possessions, 30 shillings per year, 60 shillings for three years. All other countries, \$5 per year, \$10 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter September 3, 1936, at Post Office at Albany, N. Y., U.S.A., under act of March 3, 1879. Copyrighted, 1945, by McGraw-Hill Publishing Company, Inc. Branch offices: 520 North Michigan Avenue, Chicago 11; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Washington 4; Philadelphia 2; Cleveland 15; Detroit 26; St. Louis 8; Boston 16; Los Angeles 14; Atlanta 3; Pittsburgh 22. Return Postage Guaranteed

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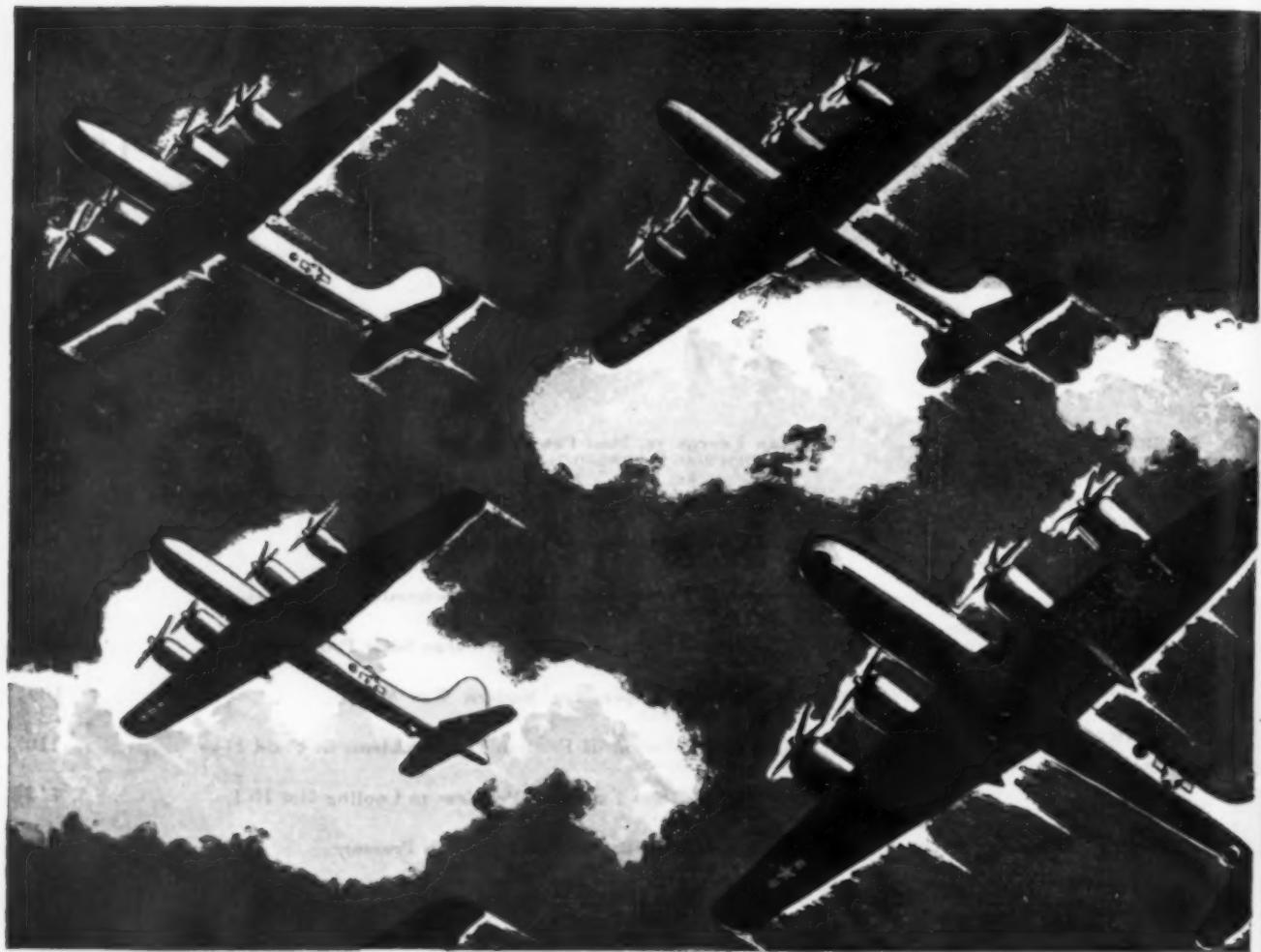
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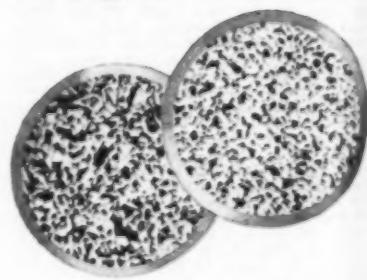
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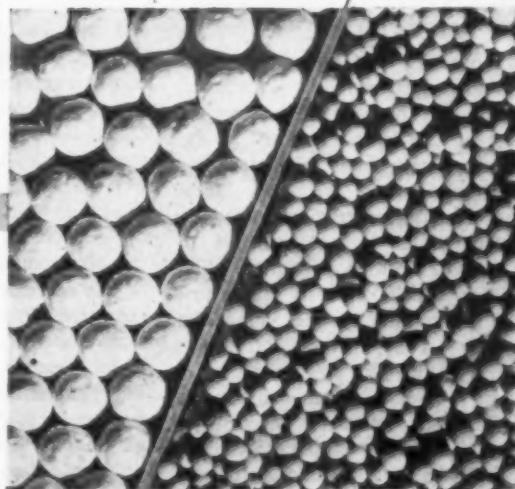


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WATCHING WASHINGTON

R. S. McBRIDE, Editorial Consultant • PAUL WOOTON, Chief of McGraw-Hill Washington Bureau • MALCOLM BURTON, Washington Correspondent

Potash industry is in line for drastic changes . . . Government's participation in this industry appears to be on the increase . . . Fabrics flameproofed with an antimony salt . . . Price indexes of Bureau of Labor revised . . . Magnesium plants now turning out metallic sodium and calcium . . . Rosin shortage becomes serious problem . . . Essential cooling systems may go back to use of freon . . . Reports on proposal policy for strategic and critical materials in postwar . . . More new deferments rules for those interested . . . It is now possible that 4-Fs with only slight disability will be called . . . Local boards told to dig deeper into 30-33 age bracket to fill quotas.

POTASH HIT TWICE

"DEVELOPMENT of potash with private capital is no longer possible." This is the interpretation by one of the outstanding executives of the potash industry of the new Interior Department regulations for development of potash on public lands. A second significant restriction on the industry came from the Department of Agriculture's Committee on National Fertilizer Policy which made its report first to the WFA industry advisory committee on fertilizers. The policy committee recommends that in the postwar period a majority of the potash requirements in the United States be met with imports and that the production of potash in the United States be restricted in order to conserve the natural resources of the country.

SOCIALIZING FERTILIZER

THE TWO specific actions above reported are part of what appears to be a general program of the present administration for great increase in the government's participation in the fertilizer business. Note: (1) The Secretary of Agriculture in his last annual report renews the recommendation previously reported that the government-owned nitrogen fixing capacity be so managed as to support a very extensive fertilizer use program fostered by the department. Privately with vigor, but only cautiously in public statements, the department is seeking to have the government retain control, perhaps even operate, about half of the existing government-owned capacity for ammonia synthesis. (2) Collaboration with TVA on phosphorus, phosphoric acid, and superphosphate manufacture is seemingly well organized further to support the government distribution of phosphate fertilizers. (3) Under the new potash regulations the government would import half of the potash,

and later would get control of something between a quarter and a half of new domestic production. Thus the government would have either ownership or distribution control of a substantial part of some of the fertilizer materials business. (4) Already Agricultural Adjustment Administration is extensively in the business of distribution of mixed fertilizer and fertilizer components.

Top executives of the fertilizer industry seem frankly puzzled as to how any effective brake can be placed on this trend to socialization and government control in their business. One important executive said recently, "We are now more under government regulation than even the public utilities. A good share of our business is actually owned or operated by Uncle Sam."

NEW POTASH RULES

PERMITS to explore and licenses to develop potash occurrences on public lands determine where potash production will take place in the United States. Hence the new permit and license rules promulgated by the Department of Interior during January are actually governing laws which fix the scope and policy of new American potash industry. The significance of the new rules was not evident from a casual reading; and even some of the important executives of the industry missed their full implication and meaning for some weeks after they were published. Only recently was it realized fully what these rules meant and how they would virtually prevent any further private capital expenditures for these purposes.

Most important in discouraging private enterprise are the provisions in the new regulations which make arrangements for the Interior Department to get ownership of 25 to 37.5 percent of the entire

production from government lands developed hereafter. Up to 25 percent of all production under these rules must be made available for the purchase of the department at a price to be determined by the secretary. Thus the government by this "set aside" provision will be able without regard to industry needs or wishes to take a minimum of 25 percent as its quota of the business. The rules also provide that the royalty which may range from 2 percent as a minimum, to 12.5 percent specified for development periods, may be taken in kind rather than in money. Incidentally, the rules provide for the minimum royalty of 2 percent but only imply that the upper limit on royalty after license is likely to be 12.5 percent. Until now royalties have never exceeded 5 percent. Also, in the past, there was nothing set aside and the government had no right to demand its royalties in kind.

Numerous other features of the rules are more rigid than formerly, substantially increasing the control by the government of even that part of the business which private capital nominally manages. Privately, some people close to officials who make policy imply that the purpose of all this was to see to it that the government could, at its option, take over the potash business as fast as present leases are worked out. Apparently the four major companies now producing potash can continue for perhaps 10 to 15 years at present rates without exhausting the reserves to which they have acquired rights under existing regulations. The new regulations, of course, do not become retroactive.

FABRIC FLAME-PROOFING

EXTENSIVE use of flame-proofed fabrics for tents, ship board use, and many other war-time applications has speeded up both research and practical use of such fabrics. A new specification for flame-proofing of tentage and other textiles uses an antimony salt. Supplementing it there are other chemicals added which minimize mold and insect damage in the tropics. This new specification is used primarily by the Quartermaster Corps, but also extensively by the Maritime Commission, Navy, and Marine Corps.

PRICE INDEXES REVISED

SINCE increases occurred in the tax on un-denatured alcohol the price indexes which included quotations for that chemical have not taken account of the very large tax drawback or rebate commonly available to users of tax-paid alcohol. The



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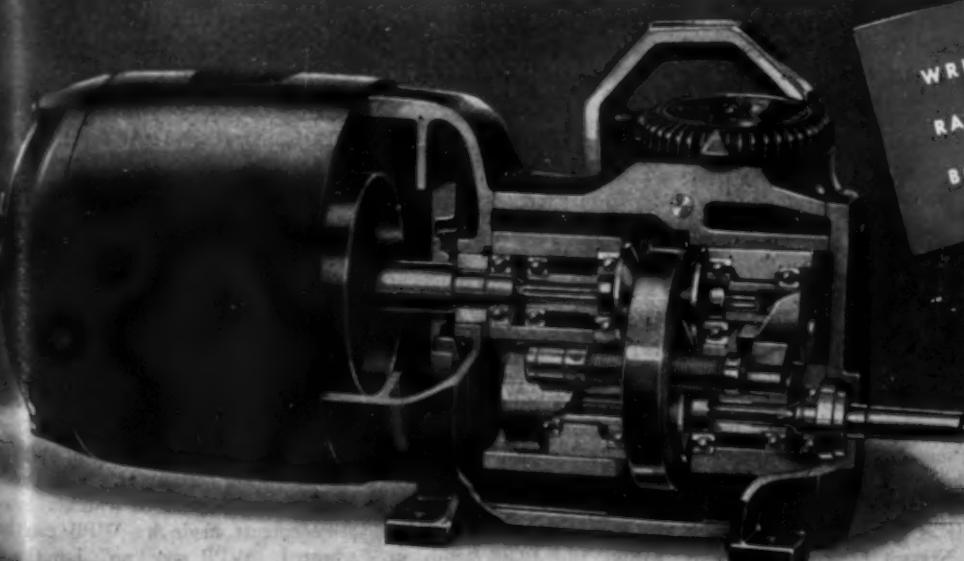
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seriously distorted the price indexes issued by the Bureau of Labor Statistics for drugs and pharmaceuticals, as well as the composite of which that index was a part, namely the wholesale price index for "chemicals and allied products." Revision has just been made and announced for both these price series which represents very large changes. For example, the drug figure for December 1944 as corrected is 106.9, as compared with the previously used figure of 217.2. The chemical and allied products change reduces the index number of the same month from 104.8 to 94.8. This change is one which has been urgently sought by Manufacturing Chemists Association for more than a year. It is necessary in using the figures to go back as far as January 1941, in order to get a corrected appraisal of trends in these fields.

NEW LIGHT METAL PLANS

Two of the government-owned magnesium plants are scheduled to render a new type of service. One is already producing calcium instead of magnesium to meet the abnormally high wartime demands for that light alkaline earth metal. Another will use its thermal reduction furnaces to make sodium. Thus the stupendous requirements for various purposes, primarily aviation gasoline anti-knock components, will be met by mid-summer without new electrolytic capacity.

WATER POLLUTION BILLS

SEVERAL senators and congressmen are again pressing bills which have as their major purpose the fixing of standards of purity and prevention of contamination of rivers and harbors. Most favored appears to be the bill which would establish in Public Health Service a unit to deal with water pollution control. That agency, if established, would prepare regulations for preventing contamination and set purity standards to be carried out under federal supervision with state cooperation. No early enactment is expected; but some developments influencing postwar controls on industry and on municipal sewage works are expected.

ALUMINUM SPEEDUP

New war demands have placed aluminum in the general class of scarce metals and brought about a 10,000,000-lb. increase in monthly production of aluminum ingot scheduled last month. The continuing need for virgin metal indicated at the beginning of March forecast the probable further increase in the number of potlines that will be returned to operation. Additional metal is needed as such and also for formula fortifications and to sweeten the scrap that is now being remelted.

Increased production announced in February was scheduled for the Aluminum Company of America plants at Massena, N. Y., Badin, N. C., and Niagara Falls, N. Y., and for the Defense Plant Corp.

plant at Spokane, Wash. Four million pounds of the increase is to come from the Alcoa operations and six million from the DPC plant at Spokane.

NEW CONSTRUCTION RETARDED

RESULTS of the first month's operation of WPB Chairman Krug's five-point program to increase war production indicates that the rigid restrictions on new construction in tight labor areas is being followed literally. (See *Chem. & Met.*, February, 1945, p. 80.) A month ago efforts to secure authorization for new plants or the expansion of old ones in No. I and No. II labor areas were getting no place. Many projects were being held up on that account. This was having an adverse effect on plans already underway.

Unfortunately, the chemical industry is located for the most part in No. I and No. II labor areas. The latest reports on the manpower situation show very little change from conditions previously reported. By the same token, there is no improvement in the program for expansion of chemical facilities.

ROSIN IS SHORT

ONE of the most difficult and annoying problems of supply now facing the Chemicals Bureau is that of rosin. It is of importance because it is the last of the natural resins available to American industry, imports having dwindled. Scarcity of labor in the woods is the root of the problem that already is acute.

Southern paper mills are competing for the same labor to cut their pulp wood and have the advantage of a higher wage scale. The paper industry has another advantage in the ballyhoo that the paper shortage has received with the result that available men have been referred to paper mills rather than to rosin producers. But now the mills which must have rosin in order to make paper are beginning to feel the pinch, like a dog biting his own tail. All elements of the industry were scheduled for a meeting at which it was hoped at least a partial solution of the problem would be found.

In the meantime, uses of wood and gum rosin have been placed under control and delivery can be made only for "preferred orders." Marine paint, food can enamel and inks for the use of Bureau of Engraving & Printing and the Government Printing Office are preferred uses.

BETTER GET ACQUAINTED

DISTRICT WPB offices are becoming more important and seem destined to remain so as long as the Army continues to take men. In most cases the WPB district manager is the chairman of the Production Urgency Committee which determines the importance of each plant in the district to the war effort. The USES must work within the PUC setup in referring men for new jobs.

It is most important for plant operators to show the district WPB manager that their product is a critical war material or a component of a critical war material. If it can be shown that a shortage in the product of a plant will impede the shooting or lead to the lengthening of the war, that plant will be in a better position to get deferment of its key employees than would otherwise be the case.

STAY OUT OF WASHINGTON

Too many chemical companies are of the opinion that their manpower problems can be solved in Washington. Result is a constant stream of visitors which is reminiscent of the early days of the war. Actually, a chemical plant can probably do at home all that Washington does in regard to the deferment of key personnel. It is necessary to show the importance of the end product to the war effort to the local committee so that that organization can take the proper action. All Washington can do is to recommend. The work, good or bad, is done in the field.

ALMOST ENOUGH FREON

RECENT relaxation of the restrictions on the use of freon indicates a better supply, but it still remains out of reach of any but the most essential uses and will continue in that condition for the duration. The bottleneck is not anhydrous hydrofluoric acid. That basic raw material is in comparatively good supply at the present time. Of course, there can be no prediction of how long that happy situation will last. The trouble with freon is in the availability of other constituents. Carbon tetrachloride is short. It in turn must compete for carbon bisulphide with rayon for tire cords and its supply also reflects the general condition of chlorine.

The easier position of freon merely means that many of the essential cooling systems that were forced to use less desirable refrigerants by the early shortage may now go back to the use of freon. Only the toughest of the restrictions have been removed and WPB cautions that nothing further need be expected.

INFORMAL CONTRACT CLAIMS

MANY firms patriotically proceeded with war business on the basis of informal, defective, or quasi contracts. Relief for such agencies was provided in the contract termination act which allows the Office of Contract Settlement to make equitable arrangements to pay firms even though they may not have a strictly enforceable contract. Firms wishing to take advantage of this are now expected to follow regulation No. 12 of the Office of Contract Settlement which defines the procedure for presenting their cases. There remains some uncertainty as to whether informal arrangements made by WPB can be so adjusted. WPB says "no"; but the Contract Settlement officer says "yes."



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CHEMICAL MISUSE PENALIZED

MISUSE of chemicals by laymen customers might severely penalize the original manufacturer if a ruling of the Supreme Court of Michigan prevailed. Hence Manufacturing Chemists Association has intervened in this case seeking to protect the industry from sweeping penalties that a recent court decision in that state clearly threatened.

The case started with a suit by an orchard owner against General Chemical Co. claiming damages for the death of certain peach trees which had been treated with a new peach borer insecticide. The company had sold the material with instructions for use which were prepared by the U. S. Department of Agriculture. When some of the trees died, the orchard owner sought redress. He failed in the first trial court; but was given relief by the Supreme Court of Michigan. The Supreme Court ruled that the material was sold without warrant because the producer had not himself made tests or had adequate tests made in the state of Michigan.

This implies that a manufacturer promoting a new agricultural chemical might be compelled to have tests made in each of the 48 states. MCA wishes to prevent any such extreme rule becoming a precedent in the courts. It is not seeking to defend the one company member against damages *per se*. But it does seek to prevent a case against any company becoming the basis for a multiplicity of suits simply on the ground that every condition must have been tested before any marketing can start. The argument is that sale under recommendations of the U. S. Department of Agriculture should be considered proper even though the department may be wrong.

OUTPUT ABOVE RATING

SEVERAL government synthetic ammonia plants are now producing at 20 to 50 percent more than rated capacity. Some of the newcomers in the industry have devised modifications for ordinary practice that have eliminated bottlenecks which formerly limited production. Thus the actual capacity of Ordnance owned establishments is probably a thousand tons per day above the normal capacity rating.

Completion of two new units for ammonia synthesis at two arsenals gives promise of adding a minimum rated capacity of 300 tons per day in the very near future. The actual production at these new establishments will probably be well over 400 tons per day.

STRATEGIC MATERIAL RECOMMENDATIONS

ARMY and Navy Munitions Board has reported to Congress, and the Senate committee has released most of its report, on a proposed policy for strategic and critical materials in the postwar period. This pro-

gram is made necessary by requirements of the surplus property act under which the limit on postwar stock piles to be held by the government is to be determined in accordance with this board's findings unless Congress intervenes.

The board has set up new definitions for classes or groups of strategic and critical materials. Most significant is the group "for which stock piling is deemed the only satisfactory means of insuring an adequate supply for a future emergency." The board has recommended minimum and maximum stock pile quantities for each of this group of commodities; but the exact figures are still withheld from publication for security reasons.

LAMINATES DO THE "IMPOSSIBLE"

WAR Production Board points out that plastic lamination of wood has made entirely practical many types of marine construction that would have been literally impossible without this new technique. Ship parts, built up timbers, and many sea-going accessories are being made on a huge commercial scale with great advantage for naval and landing craft. In many cases even the finest of virgin forests never supplied pieces of wood large enough and strong enough to do the things that are an every day achievement of this plastic-bonded material. The successful techniques give promise of furnishing an entirely new material of industrial construction for post-war usage, the enthusiasts point out rather persuasively.

CENSUS OF MANUFACTURES

BUREAU of Census is working on a program under which a complete census of manufactures will be taken early next year covering production during 1945. Chemical and related industries will be surveyed by questionnaires that will be sent out shortly after New Years. They will include the customary questions as to employees, compensation paid, and other general figures, as well as questions as to major raw materials consumed and principal products made.

PENICILLIN PRETEST ASKED

Food and Drug Administration executives have suggested to Congress an amendment of the law under which that agency works that will require makers of penicillin to submit their products to government test and certification before marketing. If such amendment is approved by Congress this commodity will be handled much as insulin products have been in the past. Manufacturers would under it not be permitted to market until official approval of purity and potency had been given.

This request now has the support of practically all of the important drug and pharmaceutical groups. It was opposed at first because it appeared that F&DA might be seeking tremendous extension of author-

ity over all sorts of industrial products. That misunderstanding was eliminated by a frank policy statement issued in February. It is definitely emphasized that only in materials of unusual character does F&DA seek to have pretest authority. In the majority of commodities they intend to continue as formerly, merely the supervision of normal distribution practice.

NEW DEFERMENT RULES

PRELIMINARY rules for the deferment of men under the new Selective Service regulations specified: "That no man can be certified for deferment unless he is doing work that is indispensable in an activity that is included within the WMC 'list of essential activities.' That no such indispensable man can be certified for deferment if he can be replaced from less essential work within the plant or establishment or by recruitment from without. That any such man shall be considered as replaceable if a recruit or transfer is available and can be qualified to perform his work through three months of intensive training."

4-F'S MAY NOT BE EXEMPT

THE CHEMICAL operators would do well to re-examine the records of the 4-F's in their plants with the idea of providing replacements for those who have only a slight disability. The warning has been unofficially given to the industry not to be caught off base if the Army should suddenly lower its physical standards. If the Army's need for men should continue, it might be found that while a wooden leg would keep a man out of the services, a punctured ear drum would not.

REPLACEMENT TABLE REVIVED

At the time of going to press, it looked as if the old replacement schedule for plant employees would again become an important tool in the handling of draft deferments. Unofficial advice to the chemical industries at that time was for firms to revive their replacement schedules if they had any. Firms that got along on an individual replacement basis were warned to get out such a list. Without it, Selective Service may take their employees without discrimination.

THE 30-33 REGISTRANTS

NEW regulations of Selective Service affect men up to the age of 34. A memorandum to local boards told them to dig deeper into the age brackets of 30 through 33. Registrants of those ages to be eligible for deferment must be necessary to, and regularly engaged in, an activity in war production or in support of the national health, safety or interest.

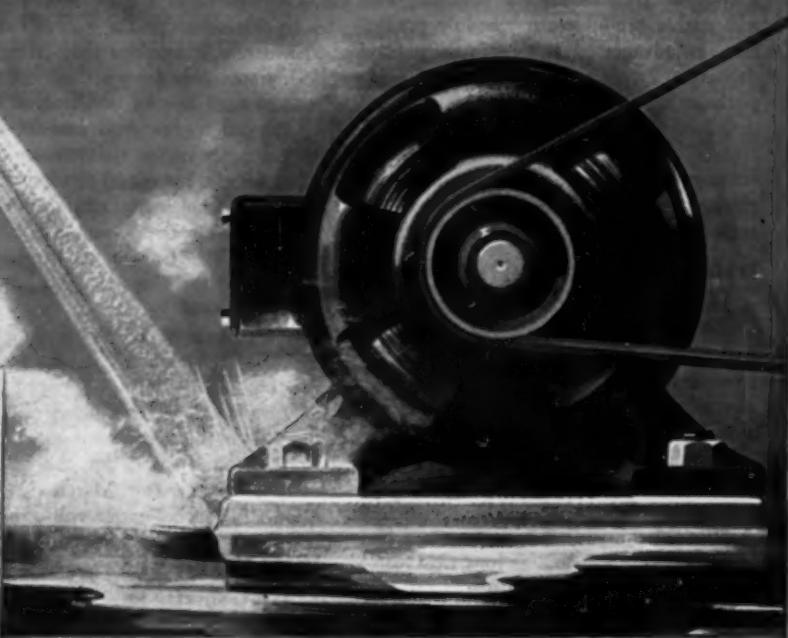
Previously the only requirement was that registrants in this age group, to be eligible for deferment, must be regularly engaged in an activity in support of the national health, safety and interest or in an activity in war production.

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High temperature silicone insulation was first made possible by **DC** Varnishes. These new heat stable resins are natural complements to the inorganic spacing materials—mica, Fiberglas and asbestos. Dow Corning Silicone Varnishes provide bonding and filling dielectrics which are highly resistant to heat, moisture, oil and chemicals.

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DOW CORNING 993... available in commercial quantities, is a heat curing, high temperature stable silicone varnish for impregnating motor stators, transformer coils and other electrical equipment; for varnishing Fiberglas or asbestos served wire; for varnishing Fiberglas and asbestos electrical insulating cloths, tapes, tying cords and sleeving; for bonding Fiberglas and mica combinations.

Dow Corning

INTERPRETATIONS

This installment covers orders, rules and regulations issued by the War Production Board and the Office of Price Administration during February, 1945. Copies of each item interpreted here may be obtained from the appropriate federal agency.

PHTHALIC ALKYD RESINS

AN AMENDMENT to Schedule 59 of Order M-300 requires consumers of phthalic alkyd resins to submit a purchase order to their resin supplier together with a copy of their allocation request. This will enable producers to schedule production in advance and give more prompt delivery. Proprietary coatings containing phthalic alkyd resins are covered to some detail in the revised schedule. New limitations on phthalic anhydride content of coatings for civilian insulation, cans and closures and electrical equipment have been included.

HYDROFLUORIC ACID

THE INDUSTRY committee has recommended that allocations of anhydrous hydrofluoric acid be continued but also recommended that end use restrictions be liberalized as soon as production capacity is sufficiently expanded to satisfy military and essential civilian demands. This will permit producers to explore postwar commercial possibilities of this chemical. Production of anhydrous hydrofluoric acid is expected to reach 36,200 tons this year as compared with demands of 25,256 tons last year. Acid grade fluorspar is in ample supply.

PHTHALIC ANHYDRIDE

WPB HAS stressed the need for larger capacities for producing phthalic anhydride in view of increasing requirements for this chemical in plasticizers, esters, dye and dye intermediates. Current estimates based on existing and authorized facilities, place productive capacity by the end of this year at 170,000,000 lb. WPB pointed out that if annual naphthalene production were increased by about 10,000,000 lb. it would be possible to have a corresponding increase of phthalic anhydride production of at least 7,000,000 lb. from any additional phthalic anhydride production facilities. It also was suggested that further investigation be made into the possibility of substituting orthoxylene for naphthalene in the anhydride plants now in operation.

ALLOCATION CHEMICALS

SIMPLIFIED procedure to obtain extension of authorization for use of allocated chemicals was announced on February 13. A single letter may be written to WPB, Chemicals Bureau, listing all allocated chemicals and allied products for which an

extension of authorization is requested. The applicant should list each material, the applicable M-300 schedule or other order, each use for which authorization has expired, the unused quantity previously authorized for that use, the original allocation period, the date the material was ordered from the supplier, the requested shipping date, the date of arrival, and the requested time extension. If a number of materials are to be used together this fact should be mentioned.

GUM AND WOOD ROSIN

ON FEBRUARY 7, gum and wood rosin were placed under the controls of Order M-340 which provides that ratings are to be honored only for preferred orders when accompanied by the certification specified by the order. Preferred uses for rosin are for marine paint for maintenance of ocean-going vessels, for orders rated under P-149 for can enamel manufacture, and for ultimate use by the Government Printing Office or the Bureau of Engraving and Printing of the Department of the Treasury.

On February 28, WPB issued Order M-387 which limits the use of rosin in various end products. Between February 28 and March 31 consumers of rosin were limited to the use of not more than one third of their quota for the first quarter of this year. After March 31, the full quotas for each quarter will apply.

CHROME PIGMENTS

AMENDMENT to M-370, governing chrome pigments, prohibits toll arrangements for the use of these pigments. Users of paint are forbidden to purchase pigments that in turn are to be sent to paint producers for processing. Paints for airport markings are included in the exempt orders for Class A pigments. This was accomplished by a redefinition of Class A pigments.

ADDITIONS TO M-300

MILITARY requirements for yellow iron oxide pigments have grown to such an extent that these chemicals have been placed under allocation control of Schedule 90 of Order M-300. These pigments, defined in the order as synthetic hydrated iron oxide pigments, are used in the production of paints and coatings for food containers and duck used in tentage.

Increased military demands also have caused ethyl ether to be placed under Schedule 91 of M-300. This product is used chiefly in the manufacture of smokeless powder. Other uses are in producing anesthetics, drugs, and ethylamine used in manufacturing synthetic rubber. Exempt from this order is ethyl ether produced in government-owned smokeless powder or

synthetic rubber plants and which is delivered or consumed by any such plant.

Labor shortages have cut down match production and military demands for matches have grown, hence distribution has been placed under Schedule 92 of M-300 with March 1 the initial allocation date. Production of matches in 1945 is estimated at 460 billions as against a normal of more than 480 billions. The military will require the entire production of strike-on-box matches, and about 35 percent of the book matches.

PRICE REGULATIONS

MAXIMUM retail prices for a new grade of ammonium nitrate containing 33.5 percent nitrogen, now offered by Canadian producers were established on February 1. In the northern and eastern sections where most of the new material is expected to be used, the cost will be \$1.70 a ton more than the old 32.5 percent grade.

Grinders and liquefiers of imported solid quebracho extract may increase their ceiling prices. Effective February 15, allowable increases are 45c. a 100 lb. for liquid extract, 35 percent tannin; 83c. a 100 lb. ground extract no tannin basis—for oil well drilling; and 90c. a 100 lb. for ground clarified extract, 70 percent tannin.

Ceiling price for anti-freeze products containing at least 95 percent glycerine by volume is \$2.65 a gal. or 67c. a qt. For material containing less than 95 percent glycerine, the maximum is computed by adjusting the above figure to reflect the glycerine content. For sales in parts of several western states, sellers may add 20c. a gal. to compensate for increased cost of glycerine in that area.

Increased prices have been authorized for primary chromium chemicals. Effective February 17, increases were 50c. a 100 lb. for sodium bichromate, crystal or granular, and powder, and for neutral sodium chromate, anhydrous or crystal; 50c. for sodium bichromate liquor and sodium chromate liquor, per 100 lb. equivalent weight of sodium bichromate crystals contained; 25c. a 100 lb. for one-bath chromium tanning compounds, dry basic chromium sulphate types; and 75c. a 100 lb. for chromic acid.

To offset wage increases to miners, prices for Tennessee phosphate rock have been marked up 10c. a ton at the miners level.

A superior talc conforming to more rigid specifications than those for which maximum prices were originally established, has been granted a maximum of \$17.50 a ton f.o.b. Zurich, Calif. The talc is mined in Esmeralda County, Nev. but the shipping point usually is Zurich.

Raw hempseed oil, as of February 27, carries a maximum price of 14c. a lb. in tank cars, f.o.b. producing mill. The same differentials used for linseed oil apply where other than tank car lots are involved.

AMERICA WANTS COMPETITION

Only American Initiative Can Preserve It in World Trade

AMERICANS generally agree upon what constitutes a desirable pattern of international economic relationships. We want an expanding world trade, with minimum recourse to government-imposed trade barriers and discriminatory trading arrangements, and offering ample scope for competitive private enterprise. Because they are necessary to such trade, we want also stability of exchange rates, and national currencies that are mutually convertible at least for the settlement of current accounts. We want, too, arrangements to facilitate long-term capital loans with security to the lender and advantage to the borrower.

Few other nations subscribe to these aims with enthusiastic conviction. Some reject them flatly as impractical under the conditions likely to prevail during the postwar period, or achievable only at prohibitive cost to their domestic economies.

Unless, therefore, we can formulate a practical and comprehensive program to carry out our aims, and convince other nations that we will take a sustained and responsible part in making it effective, the international trade of the world surely will be conducted under a system of exchange controls, bilateral agreements, cartel bargains, import quotas, and direct government purchasing arrangements that are the very antithesis of the competitive system that we favor.

To agree upon a concrete American program, and to convince other nations that it is to their advantage as well as ours to accept it, is a major task of economic statesmanship. It entails reversing a trend which has persisted since World War I, and which has been intensified during the depression years of the nineteen-thirties and by the exigencies of World War II.

Clearly, that is not a task to be assumed lightly. We can hope to be successful only if (1) we have a deep conviction that what we seek is fundamentally important to the American interest, and (2) if we will take pains to understand why other nations fear that such a program may jeopardize their interests, and then make whatever accommodations may be necessary to resolve their doubts.

An expansive foreign trade policy has been advocated so vigorously and repeatedly in America recently that The Economist (of London) comments wryly upon what it terms the ironic circumstance that "the acceptance of the principles of free trade by the more literate (American) public should come at a time when the doctrines in their simplest nineteenth-century form have been pretty generally emasculated in fact and repudiated in principle by the rest of the world".

* * *

Why are we opposed to managed world trade, and for competitive world trade?

First, we are against rigged and managed international markets because we know that successful partici-

pation necessitates a comparable degree of control over the domestic economy as well. There is little debate of this fact, and those nations which accept a managed external trade as a necessary protective measure are generally willing to pay the price in internal regimentation. We are not. For us to do that would be as alien to our genius as it is repugnant to our conviction.

Second, we believe that the United States will be able to compete successfully in world markets, even though we have, and intend to maintain, wage scales far higher than those of the nations whose competition we must meet.

There is impressive evidence to substantiate the soundness of this conviction:

1. Wage scales, of themselves, do not determine the competitive position. They are meaningful only when translated into labor costs, by dividing wage rates by units produced. A recent War Production Board study shows that in manufacturing industries generally, during the period immediately before the present war, production per man hour in the United States exceeded that in the United Kingdom, Germany and Soviet Russia by a ratio of more than 2½ to 1, and that of Japan by more than 4 to 1. When comparison is made with available wage data, it appears that our labor costs are generally on a competitive plane.

2. Perhaps the best evidence of our ability to compete in export markets is the record of our demonstrated capacity to do so in the past. During the entire period between World Wars I and II, the United States consistently commanded a greater share of the world's export trade than any other nation, although the United Kingdom took a larger percentage of world imports.

3. We have been particularly successful in world trade competition in the export of machinery, vehicles, a variety of manufactured specialties, and certain agricultural products. Except in the last-named field, there is every evidence that we enjoy genuine competitive advantage over other nations, and this advantage will have been increased rather than diminished by developments during the Second World War. It is noteworthy that the goods in which we have been able to compete most successfully have generally been the products of our high wage industries rather than those in which low wages have prevailed.

* * *

It is clear that, on a price basis, we shall be able to compete successfully in postwar markets in numerous lines. It is equally clear that such an opportunity is by no means of negligible importance to our own economy as a whole. During the years in which the censuses were taken between 1909 and 1939, our exports amounted

to from 7 to 16 per cent of our entire production of movable goods. In the year 1938 our exports in each of the following lines accounted for more than 10 per cent of total domestic production of the particular product.

(The figures in parenthesis are the percentages of total production exported.)

CRUDE MATERIALS: Phosphate rock (51.5), cotton (30.5), tobacco (29.4).

FOODSTUFFS AND BEVERAGES: Linseed (49.4), dried fruits (36.2), canned sardines (29.4), rice (21.0), fresh pears (15.9), canned salmon (13.8), canned asparagus (13.2), canned fruits (13.0), wheat (12.2), lard (11.7).

SEMI-MANUFACTURES AND FINISHED MANUFACTURES: Refined copper (53.1), paraffin wax (46.3), gum turpentine (42.6), carbon black (40.8), gum rosin (38.0), borax (35.9), crude sulphur (35.6), aircraft and parts (26.8), office appliances (22.3), carbons and electrodes (21.8), printing and bookbinding machinery (18.2), agricultural implements and machinery (17.0), biologic pharmaceuticals (15.3), industrial machinery (14.4), dental instruments and supplies (14.3), automobiles (14.1), benzol (13.3), goat and kid upper leather (12.8), refined lead (12.0), radio apparatus (11.8), caustic soda (11.4), refined mineral oils (10.6).

It is of major concern to all engaged in these lines of activity and in many others that foreign markets be not closed to us. It is particularly to our interest to have export outlets for our war-expanded capital goods and equipment industries. Since we undertook an important percentage of such expansion in order to furnish munitions to our Allies, it is reasonable to ask their cooperation in cushioning what inevitably must be a drastic readjustment here. The case is strengthened by the fact that the postwar world will desperately need the equipment items that we, alone, can supply.

But our demonstrated ability to compete on a price basis will not, of itself, assure us of foreign market outlets. Transportation costs, quality of product, marketing skill, technical and repair service—all are basically important. Still more important are non-discriminatory open markets and the command of dollar exchange by prospective purchasers. Our export potentials will surely be cramped in a world organized on the basis of bilateral deals and exchange controls. The availability of dollar exchange must depend upon the level of American imports and the volume of American capital loans.

☆ ☆ ☆

How are we to explain the skepticism of other nations toward an order which to us seems so clearly to represent not only our interest but the long-range interest of the world as well?

Soviet Russia, of course, is committed to conducting its external trade through its central government. But what of the United Kingdom? Why are there so many British voices that counsel the abandonment of what has been Britain's traditional position for more than a century? If we can understand that, we shall understand the dissent from our position of most nations whose economic positions have weakened and whose fiscal problems have multiplied during the two World Wars and the ill-starred period between them.

Essentially, their case is this:

Partly, they were forced into managed external trade policies by the Axis self-sufficiency programs, adopted in preparation for aggressive war. That can be corrected only by crushing the Axis, and by establishing a world security system that will make self-sufficiency a less compelling need.

But primarily, the reluctance of peaceably inclined nations to forego restrictive controls over postwar foreign trade stems from a deep-seated fear that is even more difficult to resolve. They fear, on the basis of past experience, that their efforts to meet payment balances arising from normal foreign trade would force a deflation of their internal economies, affecting prices, credit, wages, and finally employment. Faced with the choice, as they see it, between making adjustments in foreign trade or in their domestic economies, they lean toward the former as, at worst, the lesser of two evils.

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Since the kind of world trade system we seek is dependent upon international arrangements to assure reasonable stability of exchange rates between national currencies, we are challenged to find a formula that both will provide this and at the same time allay what other nations believe are legitimate fears with respect to their domestic economies.

But at least two major steps toward resolving such doubts can be taken upon our own initiative without recourse to the intricate process of international negotiation.

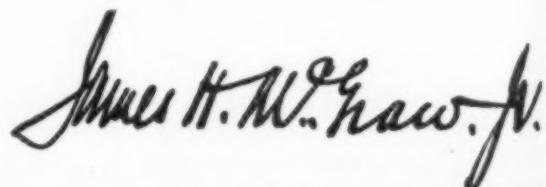
One is the rational overhauling of our tariff system, to provide other nations with increased opportunity to export to us. We can, and should, do this in a way that avoids undue cost to any segment of our economy.

The other, and probably the greatest contribution we can make toward winning a reluctant world to our point of view, will be to offer ample and convincing evidence that we are ready and able to provide a high level of employment in the United States. If we can do that, the rest of the world will wish to expose itself to our influence rather than to insulate against it, since prosperity here is the greatest single contributing factor to worldwide prosperity.

Balance of payment problems are minimized in a world of thriving trade. Britain would have little reason to resort to exchange controls if the total of postwar world imports and exports reaches an 80 billion dollar level. She may well be in a desperate plight if it should revert to the 1935 level of 40 billions.

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The United States wants a world in which private enterprise and competition play a major role. To obtain such a world will require a wiser, more understanding and firmer world leadership than this nation, or perhaps any nation, ever has exerted heretofore.



President, McGraw-Hill Publishing Co., Inc.

CHEMICAL *& Metallurgical* ENGINEERING

ESTABLISHED 1902

S. D. KIRKPATRICK, Editor

MARCH, 1945

Man Energy vs. Man Power

LAST month we visited two large war plants in a certain Midwestern city. Both were engaged in the production of metal parts vitally needed for a critical program. The fact that one plant was government-owned and operated while the other was under private management and control was all too evident, yet that in itself could not possibly have accounted for the striking difference in the attitude and performance of the workers in the two establishments. One plant suffered from a shortage of man-energy rather than of manpower. In the other was an example of what can be accomplished when men and management work together with infectious enthusiasm and efficiency.

These conditions can no doubt be found in many parts of the country, but at the time of our observation they seemed to us to be at the very root of the manpower problem which was then being debated in Congress with so much emotion and so few facts. The original "work-or-jail" bill, as passed by the House of Representatives, would have put approximately 18,000,000 under the absolute compulsion of their local draft boards. Registrants who refused to transfer to work in certain designated industries and areas would be subject to heavy fines and jail sentences—or to the honor of induction into the Armed Services.

Fortunately, a saner counsel began to prevail when the measure reached the Senate. American industry became much more vocal and effective in proving that such drastic controls would surely slow down rather than increase war production. When the National Association of Manufacturers and the U. S. Chamber of Commerce were joined by the CIO and the AF of L, it did not take long for the Senate's Military Affairs Committee to bring out a revised bill. This was designed "to reduce turnover, absenteeism and migration, and to assure manpower supply" by greatly strengthening and putting teeth into the existing con-

trols of the War Manpower Commission. Authority was given to the WMC to make in-plant surveys to eliminate labor wastage and hoarding and to promote fuller utilization of individuals, including even the Armed Forces that, through their secretaries, had been so insistent on forcing through the original measure, largely on a psychological and emotional basis. What few facts and figures were cited in these first hearings have since been proved inaccurate and highly misleading.

The truth is that there has been a letdown of labor in some industries and particularly in large plants that are government-owned and operated. To some extent the services themselves are to blame. They have built elaborate organization charts instead of efficient organizations. They have slowed down production with red tape and senseless controls. Bookkeeping and record taking have become of greater concern than the production of needed goods.

What lessons are there in all this for process engineers and wide-awake technologists? Surely we all want less of the bureaucracy and regimentation that come with unwise and unnecessary controls by governmental agencies, including the Armed Services. All of us have seen what can be accomplished when a foreman's gang or production department, or a whole plant, sets out to do a job, no matter how difficult it may have seemed at the start. Hence we must not overlook the need for helping in some way to promote the spirit and will to work that are associated with efficient production.

Finally, and most important, we must continue to put our creative enterprise and technology to work in improving processes and mechanizing operations. Efficient production in many plants today is, of necessity, the result of engineering triumph over mediocrity in man-energy and performance.

FLUORINE INDUSTRY

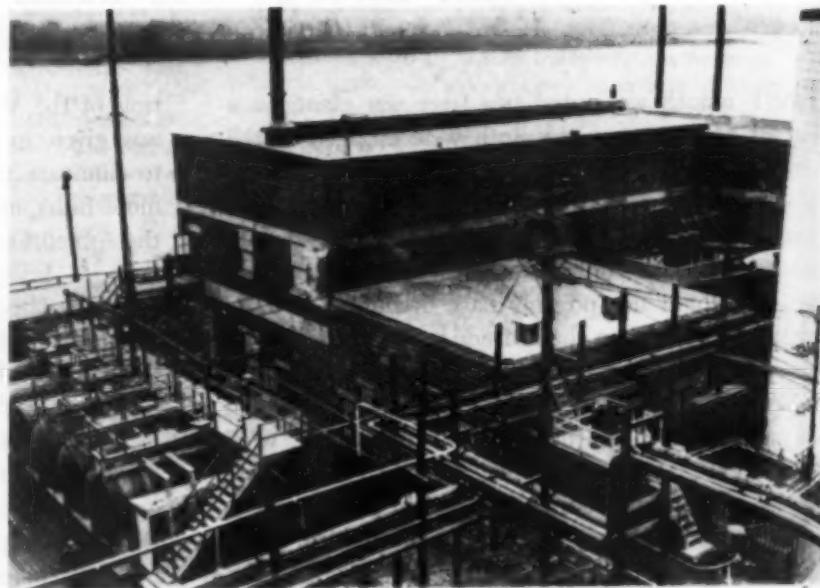
Molds a Postwar Career from Wartime Service

Among those chemicals contributing to our war effort, few deserve the "E" award more than the little-publicized fluorine derivatives. Although an upstart in tonnage, anhydrous hydrofluoric acid (AHF) is one of the "finest" of our war chemicals—the entire output is marched straight into military and essential civilian uses. Aluminum fluoride and cryolite are unconditional "musts" in light metals production. Fluorine catalysts command respect among the Generals and unless the Nazis surrender fast, another fluoride may be instrumental in blowing the lid off Germany.—*Editors*

PREWAR-WISE, industrial fluorine chemicals were represented principally by three or four well-established products, none particularly exciting. For about a decade, however, knowledge and know how were quietly accumulating; the unorthodox demands of mechanized warfare quickly brought these out into the open. As with most wartime developments, this change in fluorine technology has been more like a telescoped evolution than a revolution. Barometer of the change is the output of all fluorine chemicals exclusive of fluosilicates (estimated as 100 percent hydrofluoric acid): some 6,500 tons for 1929, 11,000 tons for 1939, and 53,000 tons for 1944 (see Table I).

FROM AHF TO ALKYLATE

Anhydrous hydrofluoric acid has three major uses—as a catalyst for producing aviation alkylate, as a raw material in the



This new HF acid unit is operated for DPC by Pennsylvania Salt Mfg. Co.

production of Freons, and for certain secret military uses. Minor outlets include a few chemicals and a new resinous material known as 114 F.

AHF alkylation, developed by Phillips Petroleum Co. and Universal Oil Products Co., permits good use of available olefins since it alkylates isobutane with propylene, allylenes, or butylene. The result, an alkylate of about 93 ASTM octane rating, is now widely used in high octane aviation blends. Production of aviation alkylate has developed into the largest single use of this acid.

First commercial AHF alkylation unit was placed in operation by Phillips Petroleum Co. in December, 1942. Now, two years later, there are 27 units in full-blast production (see Table II). One of the largest of the U.O.P. units is the million barrel Sun Oil Co. plant at Marcus Hook, Pa., which probably requires something like 500-750 tons of make-up acid yearly. Considerable caustic potash is often used as a neutralizing agent.

In one method, excess liquefied isobutane and olefin are emulsified in the pres-

ence of AHF in a hydrocarbon to acid ratio of 1:1 by volume. Reaction temperature is 75-115 deg. F., reaction time 20-30 min. Industry-wise, consumption of AHF is not as low as the 0.6 lb. per bbl. (4 gal.) of alkylate originally demonstrated in pilot plant operations. Double valving and abnormal operating conditions and feed stocks have resulted in a higher figure which probably now averages close to 1.5 lb. of acid per bbl. of alkylate. A few plants have hit the probable low of 0.5 lb. Fluorine content of the alkylate is usually less than 5 p.p.m.

Major advantages of HF over sulphuric acid in alkylation result from the higher process temperature that can be used and the greater ease of catalyst regeneration. Higher temperature permits use of cooling water, thus eliminating refrigeration. The problem of sludge acid disposal is serious in many refineries using sulphuric acid; in HF alkylation the recovery of acid by distillation is no problem. Major disadvantages seem to be the cost of the catalyst and localized corrosion problems. Some petroleum technologists now believe that

Table I—Production of Hydrogen Fluoride Calculated as 100 Percent, Short Tons

	Aqueous Acid	Anhydrous Acid	Total HF Generated*
1931	No data	<500	5,000
1933	1,358 ^b	No data	3,300
1935	1,497 ^b	No data	5,400
1937	2,198 ^b	No data	10,000
1939	2,173 ^b	No data	11,000
1940	No data	No data	15,500
1943	11,800 ^b	9,200 ^a	47,000
1944 (Est.)	12,100 ^b	24,900 ^a	53,000

^a Production for sale, Bureau of the Census.
^b Total production exclusive of that going to aluminum fluoride and synthetic cryolite, War Production Board. Probably 3,000-4,000 tons for sale.

^a Calculated from consumption of acid-grade spar, Bureau of Mines figures. Includes HF used in the production of synthetic cryolite, aluminum fluoride and all other HF derivatives. Factor: acid spar + 2.4 = HF 100 percent.

^b War Production Board.

the two alkylation processes will start neck-to-neck in the developing postwar race.

FREON STARTED IT

The Freons, however, actually fathered AHF commercially. In 1931 and 1932, the first years of commercial Freon production by Kinetic Chemicals, Inc., some 500 tons of AHF was shipped from the Easton plant of Sterling Products Co. (since 1939 a unit of Pennsylvania Salt Manufacturing Co.). The production rate of 33,000 tons of Freon-12 (difluorodichloromethane) annually by early 1945 will require AHF at an annual rate probably in excess of 12,500 tons. Production of Freon for 1944 is estimated to have been near 20,000 tons. Antimony trifluoride, incidentally, is the catalyst used in the commercial production of Freon-12. Other Freons require AHF in much more modest quantities.

Freon 12, long the principal refrigerant of the family, gained new prominence about two years ago when it began to be used as the propellant in the aerosol "bug" bombs of South Pacific fame. These insecticidal bombs contain 90 percent Freon and have been used by the millions. Postwar prospects of Freon both as a refrigerant such as in quick-freezing units and as a propellant for aerosol in-

secticides are considered promising. Use of HF acid in production of other organic chemicals has been discussed by Finger (see *Chem. & Met.*, June 1944).

Although facilities for producing AHF have been mushrooming for the past two years, production was recently trailing military and essential civilian needs by almost 20 percent. Requirements for the fourth quarter of 1944 called for 9,300 tons of AHF; only about 7,800 tons was produced. The picture for 1944 has been given by WPB as follows:

	Consumption	Production
First quarter	3,400	5,100
Second quarter	5,900	5,700
Third quarter	6,900	6,300
Fourth quarter (est.)	7,500	7,800
Total for year	23,700	24,900

Early in November, WPB officials acted to balance this situation. General Chemical Co. was authorized to construct a 6,000-ton plant at Baton Rouge, Nyotex Chemical Co. to enlarge its Houston facilities by 3,900 tons annually. Upon completion of these facilities, estimated to be in March, the production rate will increase to 38,000 tons annually, ample for all foreseeable needs (see Table III). Pre-Pearl Harbor capacity was about 6,000 tons a year!

Participating in this fluorine bonanza is aqueous HF, parent acid of most commercial fluorides. Bloated wartime demands for aluminum fluoride, ammonium bifluoride, lithium fluoride and others have naturally been reflected back into increased production of the acid. Aqueous HF has a number of important direct uses, such as in the pickling of special stainless steels and the cleaning of sand from metal castings, yet probably 90 percent of the total output now goes into the production of fluorine chemicals.

BATH SALTS FOR ALUMINUM

America's aerial might, in one sense, is dependent upon production of aluminum which, in turn, would be crippled without its two fluorine chemical crutches

Table II—Hydrofluoric Acid Alkylation Plants Now in Operation *

Ashland Oil & Refining Co.	Callettburg, Ky.
Associated Refineries, Inc.	Duncan, Okla.
Atlantic Refining Co.	Port Arthur, Tex.
Champlin Refining Co.	Enid, Okla.
Continental Oil Co.	Ponca City, Okla.
Crown Central Petroleum Corp.	Houston, Tex.
Eastern States Petroleum Co.	Houston, Tex.
Frontier Refining Co.	Cheyenne, Wyo.
General Petroleum Corp. of Calif.	Torrance, Calif.
Great Southern Corp.	Corpus Christi, Tex.
J. S. Abercrombie & Harrison Oil Co.	Sweeny, Tex.
Mohawk Petroleum Corp.	Bakersfield, Calif.
National Refining Co.	Coffeyville, Kan.
Pennzoil Co.	Oil City, Pa.
Phillips Petroleum Co.	Borger, Tex.
Phillips Petroleum Co.	Kansas City, Kan.
Premier Oil Refining Co. of Texas	Cotton Valley, La.
Republic Oil Refining Co.	Texas City, Tex.
Root Petroleum Co.	El Dorado, Ark.
Sinclair Refining Co.	Corpus Christi, Tex.
Socony-Vacuum Oil Co., Inc.	Augusta, Kan.
Socony-Vacuum Oil Co., Inc.	E. St. Louis, Mo.
Socony-Vacuum Oil Co., Inc.	Paulsboro, N. J.
Southport Petroleum Co. of Del.	Texas City, Tex.
Standard Oil Co. of Calif.	Richmond, Calif.
Sun Oil Co.	Marcus Hook, Pa.
Wilshire Oil Co.	Norwalk, Calif.

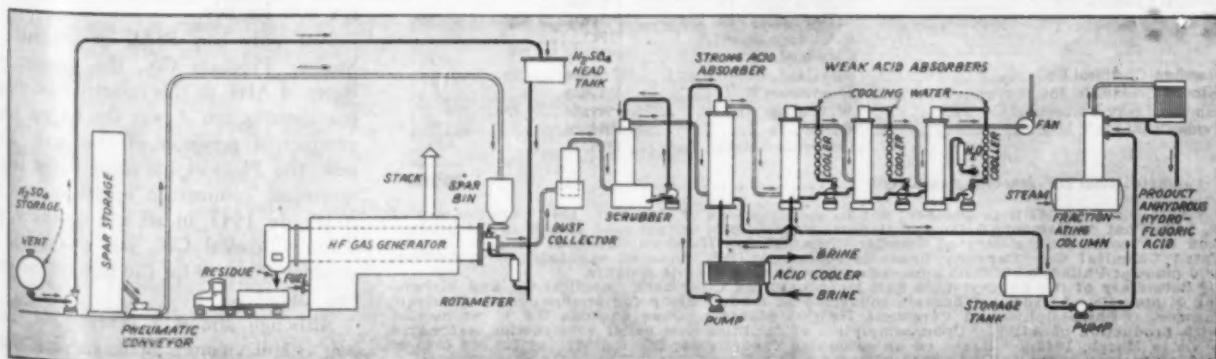
* Petroleum Administration for War.

—aluminum fluoride and sodium aluminum fluoride (cryolite). The first of these finds its one excuse for being as a flux in the electrolytic reduction of alumina. Consumption of aluminum fluoride normally amounts to some 0.3-1.0 percent of aluminum production, but under the present abnormal operating conditions it often has gone to 1.5 percent or higher.

Cryolite, made synthetically by Aluminum Ore Co. and imported to this country as natural ore from Greenland exclusively by Pennsylvania Salt Mfg. Co., is the indispensable electrolyte in the reduction of alumina. Consumption of cryolite for this purpose can be calculated as about 6-8 percent of primary aluminum production. Since aluminum output for 1943 was 919,900 tons, probably 60,000-70,000 tons of cryolite was required for this use. A large percentage of this figure represents synthetic cryolite, still first among fluorides in tonnage.

Cryolite, unlike aluminum fluoride, is not a one-purpose product. Some 3,000-4,000 tons is estimated to have been used

Generalized flow sheet for the continuous production of anhydrous HF, vital war chemical of postwar promise



in 1943 for insect control; Roark estimates that 7,500 tons may be so used in 1945. Most of this represents the refined natural product.

SAND AGENTS

Proper fabrication of aluminum and magnesium is just as important as the production of these metals. Here again, fluorine compounds show their worth. Ammonium bifluoride, silicofluoride and fluoborate have taken on a new status as sand agents in the casting of aluminum and magnesium. These agents fill the voids in sand molds by volatilizing when heated, thus inhibiting surface oxidation of the metal. Roughly, some 1-3 percent by weight of the sand of either ammonium fluosilicate or a mixture of ammonium bifluoride and fluoborate is used in casting magnesium metal. Potassium fluoborate is used for the same purpose. During the war, at least, this has been the principal use of these chemicals.

Ammonium bifluoride serves the war effort as an inhibitor of foreign yeast growth in the alcohol industry. Lithium fluoride has made war-urgent aluminum welding practical. Used on aluminum welding rod coatings, it serves as a powerful fluxing agent, is non-hygroscopic and highly insoluble. Lithium fluoride is one ingredient of phosphorescent pigments for airplane instrument dials.

Antimony fluoride acts as the catalyst in the production of Freon-12 from carbon tetrachloride and AHF; boron trifluoride catalyzes the polymerization of isobutylene to Vistanex. It is also used in

duPont's process for propionic and acetic acids from carbon monoxide and methanol or ethanol under high pressure and temperature. Boron trifluoride catalyst was instrumental in the development of butyl rubber but is actually not now used in the process.

Sodium fluoride, greybeard of fluorine chemicals, aids the war effort by helping in the production of rimmed steel for castings; it is especially useful for heats that are sluggish in rimming and that might result in second-grade ingots. The standard procedure is to add two ounces of sodium fluoride per ton of steel during teeming.

Probably 500-1,000 tons of sodium fluoride is used annually to combat cockroaches, another 250 tons for the control of chewing lice on poultry. If the Newburgh (N. Y.) and other experiments on preventing dental caries by controlled addition of fluorine to drinking water pan out as might be expected (it may be ten years before we know the answer), sodium fluoride may take on a new dignity as an industrial chemical.

Of the new fluorine chemicals, the fluoborates and fluosulphonates are to be counted among the foremost in importance. Fluoboric acid, produced commercially in 1936, has attracted attention as an agent for generating boron trifluoride at the point of consumption and, among the oil companies, as a possible catalytic agent. Potassium fluoride, bifluoride and fluoborate have greatly increased in usage as fluxes in silver soldering. In welding operations, these fluorides clean the oxide off the steel, shield the metal from oxidation and assist the flow of brazing alloy.

Sodium fluoborate is used for heat treating high-strength aluminum alloys. The metal fluoroborates, of which lead is the best known, are used in electroplating, especially for airplane engine bearings.

QUAKER TO THE CORE

Of the big six producers of inorganic fluorine chemicals, Pennsylvania Salt Mfg. Co. is one of the largest in tonnage output (see Table IV). Calculated on a basis of 100 percent HF this firm, including its affiliates and plant operating under management contract with DPC, has a total annual capacity (exclusive of natural cryolite) of approximately 15,000 tons. This represents some 28 percent of the estimated total domestic production for 1944.

Founded in 1850, the Pennsylvania Salt Mfg. Co. (henceforth PSM or Penn Salt) can justifiably be proud of its 95 years of proverbial Quaker integrity and tradition. In 1864, at the close of the Civil War, one Henry Pemberton of PSM visited the Kryolith Co. in Copenhagen and made an exclusive American import contract for 6,000 tons annually of Greenland cryolite. After 80 years, this contractual relationship is still in effect!

This mineral, known to the Eskimos as "the ice that neither floats nor melts" because of its peculiar appearance, was originally used in making caustic soda, soda, bicarbonate of soda and alum. It was not until 1900 that the insecticidal property of natural cryolite was discovered at a potato patch by a company employee, Natrona. And thus a potato bug led Penn Salt into fluorine chemistry.

History of AHF is interesting. It was first produced commercially in 1931 by Bishop at the Easton plant of Sterling Products Co., and in 1931-1932 this plant shipped some 500 tons of AHF to the first industrial customer. Shortly thereafter Kinetic Chemicals, Inc. built its plant at Deepwater, N. J., a unit that is still the largest in the country. Output of the plant is absorbed almost entirely in the production of the Freons. A few years later Harshaw Chemical Co. began the commercial production of AHF, thus becoming one of the first producers to offer the acid for sale.

Not only was PSM, as successor to Sterling Products Co., the pioneer producer of AHF in this country, but until a few months ago it was the largest single commercial producer of this acid. Even now, the Philadelphia plant is the largest individual commercial operating unit in AHF. In 1943 an affiliate company, the Tulsa Chemical Co., was established to produce this acid for the high-octane gasoline industry.

Although almost a century old, Penn Salt is still vigorous in its research think-

Table III—Domestic Producers of Hydrofluoric Acid

Anhydrous Acid	Plant Location	Ownership	Capacity ¹
General Chemical Co.	Marcus Hook, Pa.	Private	.....
	El Segundo, Calif.	Private	.....
	E. Chicago, Ind.	DPC	2,000
	Baton Rouge, La.	DPC	6,000 ²
	Cleveland, Ohio	Private	.....
	Deepwater, N. J.	Private	.....
	Houston, Tex.	Private-DPC	3,000 ³
	Philadelphia, Pa. ⁴	Private-DPC	6,500
	Easton, Pa.	Private	.....
	Tulsa, Okla.	Private	.....
Estimated total AHF plant capacity ⁵			38,000
 Aqueous Acid			
Aluminum Ore Co. ⁶	St. Louis, Mo.	Private	.....
General Chemical Co.	Marcus Hook, Pa.	Private	.....
	El Segundo, Calif.	Private	.....
	E. Chicago, Ind.	DPC	.....
	Cleveland, Ohio	Private	.....
	Deepwater, N. J.	Private	.....
	W. Chicago, Ind.	Private	.....
	Easton, Pa.	Private	.....
	Cornwells Heights, Pa. ⁷	DPC	.....
Estimated total HF generating capacity ⁸			62,000

¹ Authorized by WPB in October; not in operations as of February, 1945. ² Subsidiary of E. I. du Pont de Nemours & Co. and General Motors Corp. Output used largely in the production of Freons. ³ Subsidiary of Stauffer Chemical Co., Harshaw Chemical Co. and Consolidated Chemical Co. Capacity figure includes only DPC-financed expansion. ⁴ Anhydrous acid made at Philadelphia from aqueous acid made at Cornwells Heights.

⁵ Subsidiary of the Pennsylvania Salt Manufacturing Co., Ozark Chemical Co. and Mahoning Mining Co. ⁶ Hydrogen fluoride consumed as made, chiefly for production of aluminum fluoride. Philadelphia and Cornwells Heights plants produce aqueous HF in connection with production of AHF. ⁷ Upon completion of facilities now under construction, estimated to be in March, 1945. ⁸ Based on an estimated capacity for the industry of 150,000 tons of acid-grade spar annually. ⁹ As approximated tons per year.

ing. Imagination, patient money and time—these are the keywords to PSM research. Actually, 30-40 percent of sales between 1940 and 1944 has been on products developed over the previous ten years. Of the research and development staff of 85, probably at least a fourth are occupied with developing new fluorine derivatives, uses or processes or with improving the company's present fluorine line of products.

CORNWELLS HEIGHTS

Newest PSM fluorine plant is the Cornwells Heights unit on the Delaware River, near Bristol, Pa. Just before the outbreak of war, this firm purchased about 50 acres of land at the site of this unit, intending to transfer operations of the Philadelphia plant. Instead, since the German submarine was a threat to the importation of Greenland cryolite, a DPC unit for producing synthetic cryolite was built. The threat never materialized and the cryolite unit was converted into producing aluminum fluoride needed for our sky-rocketing aluminum output. The aqueous HF part of this plant began operations during May, 1943.

Fluorspar, calcined at the mill to burn off the flotation reagent, ordinarily arrives at the plant in box cars or covered hopper cars as a fine powder containing less than 0.5 percent moisture. Spar is unloaded into a storage silo by means of an air conveyor system and is transferred by the same system to steel, conical-bottom feed hoppers from which it is continuously fed to the still through an automatic Richardson scale and automatic feeders.

To keep formation of hydrofluosilicic acid at a minimum, acid-grade spar should contain less than 1 percent silica. Sulfuric acid of 98.5-99 percent strength is fed through a rotameter into the still. Feeding of both spar and acid as well as discharge of residue are continuous; previous practice has generally been semi-continuous or batch. Continuous operations give a more uniform evolution of HF gas and better absorption yields.

Furnaces, of which there are five in operation and one being installed, have shells of 0.75-in. thick mild steel 6 ft. i.d. and 40 ft. long with a pitch of 0.25 in. per ft. Proper retention of the charge is attained by aid of a circular dam near the discharge end. The retort rotates slowly, approximately 1 rpm. The shell is enclosed in a brick setting and is fired with producer gas made at the plant. An arch at the fire end prevents the hot gases from striking the shell directly.

Spar-acid ratio in the feed is 1:1.3, indicating a slight excess of acid over the theoretical requirements. When stills are operated over a sustained period and under controlled conditions, unreacted spar in the residue is less than 1 percent. Rated capacity of each furnace is 6 tons of 80

Table IV—Principal Producers of Inorganic Fluorine Chemicals

	Harshaw Chemical Co.	Aluminum Ore Co.	Pennsylvania Salt Mfg. Co.	General Chemical Co.	Lindsay Light & Chemical Co.	Kinetic Chemicals, Inc.
Aluminum fluoride	X	X	X ²	..	..	..
Ammonium bifluoride	X	..	X ²	X ²	..	X ²
Anhydrous hydrofluoric acid ¹	X	X ²	X	X	X	X
Aqueous hydrofluoric acid	X	X ²	X	X	X	..
Antimony trifluoride	X	..	..	..	..	..
Boron trifluoride	X	..	..	..	..	..
Fluoboric acid	X	X	X ²	X	..	..
Lead fluoride	X	X	X	X	..	..
Lithium fluoride ³	..	..	..	..	..	..
Sodium fluoride	X ²	X	X ²	X	X	..
Sodium bifluoride	..	X	X	X	..	..
Synthetic cryolite	..	X	X ^{1,2}	..	..	..

¹ Also produced by Nyetox Chemical Co. and Tulsa Chemical Co. ² Primarily for consumption in own operations. ³ Produced by Foote Mineral Co., The Metalloy Corp. and Maywood Chemical Co. ⁴ Not in production at present. ⁵ Manufactured under contract with DPC.

percent acid per day. Thus the plant has a total daily capacity of 30 tons of 80 percent acid, is now being jacked up to 36 tons.

Calcium sulphate residue is discharged continuously from the stills and transported by a set of drag conveyors and elevators to a hopper from which it is periodically trucked to an adjoining dump yard. The amount of residue can be calculated roughly as 1.75 times the weight of spar charge.

Gas consisting of 70-75 percent HF is pulled off through a 14-in. steel header at the feed end of the still at about 250-350 deg. F. After passing through a cyclone dust collector to remove spar carryover, it is scrubbed countercurrently with condensed acid in a steel "scrubber acid" tower provided with a bottom receiver tank. Sulphuric acid entrained in the gas is removed and recirculated or bled back into the still. The recirculating pump is of lead construction. Temperature of the gases is lowered by this scrubber to about 150 deg. F.

Gases from the six stills are pulled through a common header into one of three complete absorption systems; each of these consists of one scrubber tower and overflow box, two steel strong acid absorption towers, five weak acid absorption towers and seven circulating pumps. All towers are about 15 ft. high and have diameters of about 3.5 ft.

In the entire tower system, HF gas flows countercurrent to acid. Water is sprayed down the last tower; acid from this tower, now about 10 percent HF, is circulated over the second tower where it is concentrated further. This process is continued, the concentration of acid from the bottom of the fifth weak acid tower being about 50 percent. This acid then flows through the strong acid towers, from which it emerges as 80 percent. Absorp-

tion of HF gas is virtually quantitative. The entire system is operated by a fan on the vent. The main product of the plant is 80 percent acid; very little weak acid is formed. Final product is run by gravity to one of three steel storage tanks.

Cooling is necessary to complete the absorption. Strong acid is refrigerated in a brine-cooled shell-and-tube exchanger to 20-40 deg. F. by a standard ammonia system at present with a capacity of 150 tons but to which an additional 75 tons is being installed. Weak acid is not refrigerated but is cooled in conventional water-sprayed Karbate coils.

Strong acid towers are of the plate-and-ring cascade type. Weak acid lead towers, now of the cascade design, will soon be replaced with carbon Raschig ring packings. Strong acid pumps are of mild steel while those for acid under 80 percent are of Karbate.

Cornwells Heights 80 percent acid is

Penn Salt Mfg. Co. fluorine chemicals flow chart

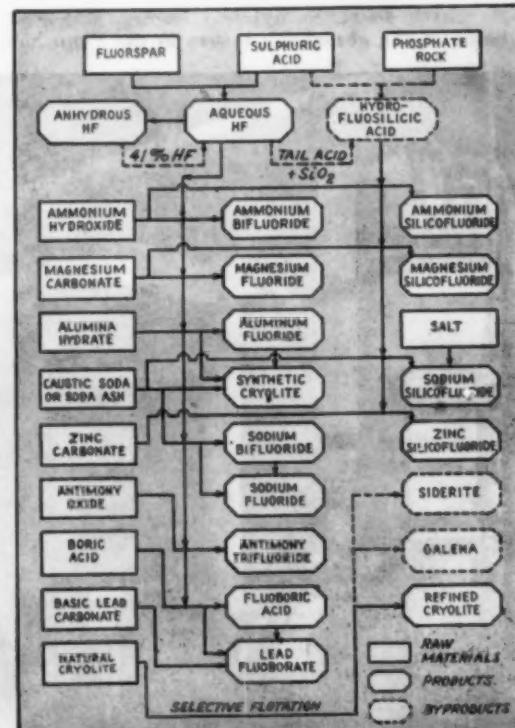


Table V—Fluorine Chemicals Produced by Pennsylvania Salt Mfg. Co.

	Nacon, Pa.	Easton, Pa.	Cornwells Heights, Pa.	Philadelphia, Pa.	Tulsa, Okla.
Aqueous hydrofluoric acid	X	..	X	X	..
Anhydrous hydrofluoric acid	X	..	X	X	..
Hydrofluosilicic acid	X	..	..	X ¹	X ¹
Zinc silicofluoride	..	..	..	..	—
Magnesium silicofluoride	X	..	..	..	..
Ammonium silicofluoride	X	..	..	..	..
Ammonium bifluoride	X	..	..	..	..
Sodium bifluoride	X	..	..	..	..
Sodium fluoride ²	X	..	..	..	..
Magnesium fluoride ³	X	..	..	..	..
Fluoboric acid	..	X	..	..	..
Lead fluoride	..	X	..	..	..
Ammonium fluoride	X	..	..	..	..
Sodium fluoroborate	X	..	..	..	..
Potassium fluoroborate	X	..	..	..	..
Aluminum fluoride ⁴	..	X	..	..	..
Synthetic cryolite ⁵	..	X	..	..	..
Refined natural cryolite	..	X	X	..	..

¹ Produced as a byproduct of AHF operations. ² At present not in operation. ³ Manufactured under contract with DPC.

moved by truck tank to the Greenwich Point, Philadelphia, plant where it is concentrated to AHF. Part of the low-strength reboiler acid from the AHF still is shipped back to Cornwells Heights, stored in Neoprene-lined steel tanks and fed back to the absorption system for fortification.

AHF OPERATIONS

Penn Salt's Philadelphia plant is at present the largest single commercial installation in this country for producing AHF. Operating capacity of this unit is now 20 tons per day. The present continuous rectification system started operations during April, 1944, previous to which production of this acid by PSM was conducted at Easton.

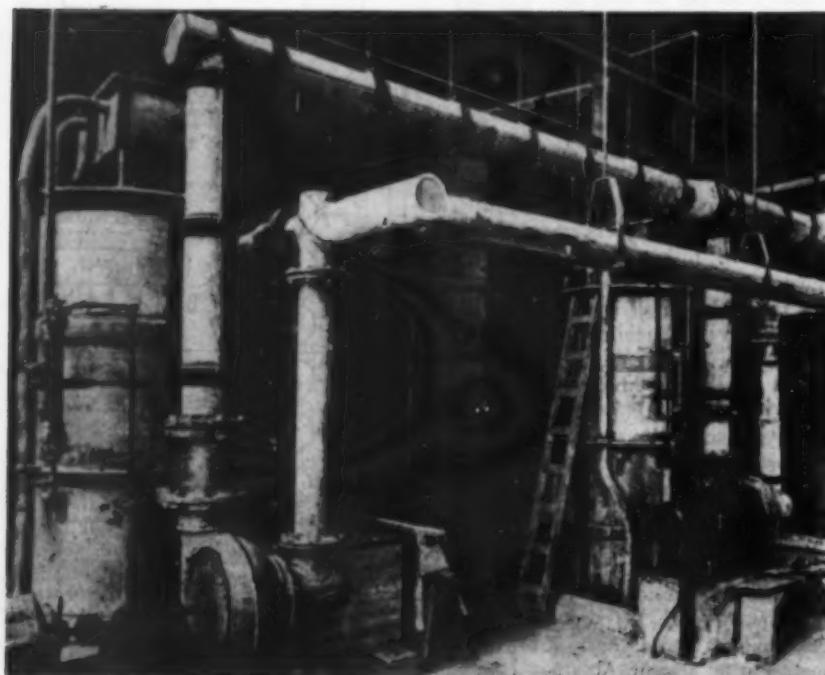
Strong acid is trucked from Cornwells Heights and stored in mild carbon steel tanks from which it is pumped at a controlled rate to the distilling column. The operation is continuous. This column, some 3 ft. in diameter and 10 ft. high, is of copper construction and conventional bubble cap design. The copper reboiler is a standard kettle type with a removable bundle of 1-in. copper tubes through which steam is passed. A thermostatic bulb in the reboiler regulates the flow of steam.

AHF, which boils at 67.8 deg. F. under atmospheric pressure, forms a constant boiling mixture with water that contains about 37 percent HF; in actual operations the stripping is carried out at approximately 240 deg. F. so that the bottoms acid is 40.41 percent. AHF leaving the still is condensed and cooled to about 50 deg. in a conventional steel shell-and-tube condenser 3 ft. in diameter and some 15 ft. long. The condenser is chilled with brine by means of a 90-ton Freon refrigeration system. Condensed acid flows by gravity through steel lines to one of two insulated product storage tanks. These, constructed of 1-in. mild steel, have a capacity of 50 tons each. Water scrubbers on all vents remove traces of undenosed HF gas.

Residual acid of 40.41 percent HF is bled continuously from the reboiler through a water cooler to a storage tank from which it is trucked back to Cornwells Heights for fortification to 80 percent and for use in producing aluminum fluoride.

Monel valves are used throughout this plant and have given good service. Copper, used for the column and reboiler, is as satisfactory as any available material under the specific operating conditions.

Some of the absorption towers in the Penn Salt unit at Cornwells Heights



When the submarine menace to natural cryolite never materialized, facilities originally designed to make synthetic cryolite at Cornwells Heights were converted into making aqueous HF. Since not all weak acid coming from AHF production can be admitted to the HF absorption system, much of the balance has been used in making aluminum fluoride for use as a flux in producing primary aluminum.

ALUMINUM FLUORIDE FLUX

Acid of 40.41 percent is run into storages, diluted to 15 percent and then pumped into the reactor feed tank. Bayer hydrate of alumina is dropped from one of four cone-bottom storage bins and conveyed to the hopper bins. Both acid and hydrate are charged batchwise into one of two make-up tanks and agitated thoroughly. The batch is dropped into the crystallizing tanks before any appreciable reaction occurs. Make-up tanks are of steel construction lined with rubber and structural carbon brick. Temperature of the mass is kept at about 190 deg. F. by passing water or steam through internal coils.

In the crystallizers, the reaction is completed and crystallization of $\text{AlF}_3 \cdot 3\text{H}_2\text{O}$ occurs. Originally the three crystallizers operated on the batch principle, but fluctuation of the liquid level caused crusts of crystals to plug lines. They have now been made continuous and connected in series. The slurry is heated to about 200 deg. and agitated continuously. Retention time is about an hour in each vessel or a total of 3 hr. Crystallization is then complete.

The mass is then dropped into an agitated slurry tank from which it is pumped into one of two rubber-lined Dorco continuous rotary suction filters. Up to this point, all piping in the flux plant is rubber-lined. Washed cake, containing some 10 percent moisture, drops onto a belt conveyor which feeds the calciners. These, fired with producer gas made at the plant, are horizontal kilns that rotate at approximately 6 rpm. They are 40 ft. long with 20 ft. at the firing end lined with fire brick. Temperature in the combustion box is 1,200 deg. F. and in the stack about 350 deg. F.

Retention time in the calciner is about forty-five minutes during which time the hydrate is converted into a granular powder containing 86 percent or more AlF_3 and 5 percent or less water. The product is discharged continuously and elevated into one of two cone-bottom silos, each with a capacity of 35 tons, from which it is packaged into 50 lb. paper bags closed by end-sewing.

Design capacity of this plant was 10 tons of product daily, but operating and equipment improvements upped this to 15 tons. Because of curtailed aluminum production, the plant is now operating

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at only 5 tons per day. The larger calciner is being converted into a dryer since wet flotation fluorspar may soon be received.

EASTON'S FLUORIDES

In general, production facilities for hydrofluoric acid at Easton works are similar to those described for Cornwells Heights. Easton has three furnaces, two of which are semi-continuous in operation. The continuous still, installed about two years ago, is similar in design and operation to those at Cornwells Heights.

Batch stills, which are oil fired, have a diameter of 6 ft. and a length of 40 ft.; they are charged and dumped about every 40 min. The furnace shell, which is 0.75 in. thick, is run on trunnions and rotates at about 1 rpm. Residue is dumped at about 425 deg. F. and contains 1.1.5 percent undecomposed spar and 2.5-3 percent free sulphuric acid. Usually some 80-90 percent of the silica in the spar is decomposed into hydrofluosilicic acid. This plant formerly ground fluorspar in a Hardsinge ball mill; it now uses dry flotation spar.

Aqueous acid of all commercial strengths is made at Easton—80, 60, 52, 48, 40 and 30 percent. Acid of 80 and 60 percent HF is stored in steel tanks; all lower strengths are stored in lead tanks.

Normal sodium fluoride, no longer produced at Easton, was formerly made by the conventional process of neutralizing soda ash with HF in lead-lined equipment. Maximum temperature at the end of the reaction was 160-170 deg. F. Neutral slurry was centrifuged to recover crystals.

Sodium bifluoride, made in large quantities at Easton, has the same basic reactions as the normal fluoride, the chief difference being the degree of acidity in the batch. Bifluoride mother liquor from a previous batch is heated by steam coils to a suitable temperature. Soda ash is then added until neutralization is reached, after which acid and ash are added simultaneously until the proper concentration and acidity are reached. Monel stirrers used in this operation take severe punishment and have a life expectancy of only 1-2 months.

That sodium bifluoride is not a cinch to handle is shown by the fact that one strategic piece of equipment has an effective life of about two weeks—the net result of corrosion, erosion and high temperature. Some units of the equipment used for handling bifluoride solution are lined with Neoprene.

Ammonium bifluoride production is interesting in that the heat of reaction supplies all evaporation necessary for crystallization and concentration of mother liquors. Aqueous ammonia is steam-stripped to ammonia gas by trickling down a quartz-packed tower.

Mother liquor is first run into the reactor; ammonia gas and weak acid are then alternately added. Evaporation is so vigorous that by the time the reactor is full the slurry is concentrated and ready for crystallization. This is done by natural cooling in four shallow lead pans, each with a capacity of 2,800 lb. of bifluoride crystals. Mother liquor is reworked until the accumulation of ammonium sulphate, which results in fine, needle crystals, necessitates a bleeding off.

Crystals are fed to a dryer 4.5 ft. in diameter and 35 ft. long, Neoprene-lined and built in the PSM shops at Easton. Since ammonium bifluoride decomposes at about 180 deg. F., this dryer is operated at around 160 deg. and with a large throughput of air. A balanced draft is provided by a fan on each end of the unit. After nearly four years of use it is still in excellent condition.

Hydrofluosilicic acid is largely purchased as a byproduct material from superphosphate fertilizer works, but some acid is also produced at Easton. Production includes the ordinary commercial grades used in the manufacture of silicofluorides and a special 30-35 percent high-purity grade for electric storage batteries.

Low strength acid from the tail scrubber of the HF system, already containing 15-20 percent hydrofluosilicic acid, is run into a rubber lined lead tank provided with impeller agitation. Then 120-mesh silica is added to react with the free HF present. The reaction is exothermic and usually complete within 8-10 hr., giving an acid of about 25 percent strength. This can

be concentrated to 35 percent, above which decomposition begins.

Purchased byproduct zinc carbonate used for making zinc silicofluoride contains 50 percent moisture and 10 percent sodium sulphate. The sodium salt is dissolved out by slurring the material up in tanks and washing with water. The reactors, which are open rubber-lined wooden tanks, are filled with hydrofluosilicic acid to about 60 percent their capacity. Then carbonate slurry is added until neutralization is complete. The mass is allowed to settle, after which the froth is skimmed off and the solution fed to the crystallizer unit.

Crystals of zinc silicofluoride drop and settle into the conical bottom, from which they are periodically dumped and fed into a rotary dryer lined with Monel. Temperature of the discharge end is 265 deg.

SCHOOL FOR CORROSIONISTS

Because of the many fluorine chemicals that have been made at Easton over a period of years, this plant has functioned both as a training ground for personnel and as a proving ground for processes. Practically every fluorine chemical of commerce has been made in this plant, many of them pioneered here. One of the first comprehensive reports on AHF handling and materials of construction was given by Fehr (see *Chem. & Met.*, November 1943), a graduate of Easton.

Actually, the most outstanding mark about such a fluoride plant is the characteristic signs of an unending campaign to control corrosion. Easton, whose shops make around 90 percent of its process equipment directly exposed to corrosive action, normally has a plant force of about 150, a large number of whom are concerned primarily with maintenance and development of materials of construction.

It is interesting that traces of certain metals under given conditions may increase the corrosiveness of hydrofluoric acid a hundredfold. Corrosion studies now under way at Easton, if successful, may strongly modify the design and life of certain pieces of equipment used in manufacturing processes.

Table VI—Relative Resistances of Certain Materials of Construction to Acid Fluorine Chemicals¹

	Dry HF Gas	80-100% HF	63-80% HF	Below 63% HF	Soluble Acid Fluorides ²	Hydrofluosilicic Acid	Soluble Silicofluorides
Chemical lead.....	Unsatisfactory	Very bad	Unsatisfactory	Satisfactory	Satisfactory	Unsatisfactory	Unsatisfactory
Copper ³	Excellent	Excellent	Excellent	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Monel metal.....	Excellent	Excellent	Excellent	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Natural rubber.....	—	Very bad	Very bad	Satisfactory ⁴	Excellent	Excellent	Excellent
Mild steel ⁵	Excellent	Excellent	Satisfactory	Unsatisfactory ⁶	Very bad	Very bad	Very bad
Neoprene.....	—	Unsatisfactory	—	Satisfactory ⁷	Excellent	Excellent	Excellent
Saran plastic ⁸	—	—	—	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Structural carbon.....	—	—	—	—	Excellent	Excellent	Excellent
Wood.....	Very bad	Very bad	Very bad	—	—	Unsatisfactory	Unsatisfactory

¹ Platinum is one of the most resistant of all metals to HF; silver has excellent resistance in the absence of sulphides or appreciable quantities of sulphuric acid; American Optical Co. has announced development of a new phosphorus-base glass highly resistant to HF of all strengths. ² Attacked by hydrofluosilicic acid above about 6 percent. ³ Unsatisfactory in the presence of sulphur dioxide, oxygen or oxidizing agents. ⁴ Resistant to acid of 60 percent HF cold or 52 percent HF warm. ⁵ Thoroughly deoxidized, dead melted or killed steel in which non-metallic inclusions are held to a minimum is most suitable. Cast iron is generally not suitable for AHF. ⁶ Satisfactory down to about 60 percent HF if 1.5-2.0 percent sulphuric acid is present to pacify the steel; otherwise unsatisfactory. ⁷ Up to 60 percent HF. ⁸ Unsatisfactory in vapor space. None of the other synthetic rubbers approach the resistance of Neoprene. ⁹ Specifically, sodium, potassium and ammonium bifluorides. ¹⁰ Experimental work still in progress.

R. A. BAYARD Consulting Engineer, Montreal, Canada

New Formula Developed for KILN TIME

So far as is known, the only formulas for passage time of material through rotary kilns that have attained widespread use are the four empirical equations published by the U. S. Bureau of Mines in 1927. Except for the simplest case where a kiln of uniform diameter without rings or other obstructions is to be investigated, these equations are quite complex, a fact which led Mr. Bayard to develop the formula offered here.—*Editors*

After considerable search and study of the literature relating to the time required for a charge of dry material to pass through an inclined rotary kiln, the author developed a formula for this purpose and now offers it as the simplest on record. It is based on a geometrical derivation and gives results agreeing closely with tests in various kilns. It is in line with results of experimental work published in 1927 by the U. S. Bureau of Mines in Technical Paper 384.

As kiln operators are interested chiefly in results, only enough of the derivation follows to allow the formula to be understandingly used. Particles in the charge of a rotary kiln go through a series of cycles starting at or near the bottom of the kiln, rising with the rotation of the kiln, but without relative motion to it, to an angle where they start to slide or roll back down counter to its rotation. They come to rest near the bottom of the kiln, and then start the cycle over again. The length of the kiln, divided by the distance moved along its major axis per cycle, multiplied by the time taken to complete a cycle gives the total time in the kiln, which expressed as a formula, is:

$$T = \frac{0.037(\alpha + 24)}{DNS} L \quad (1)$$

where T = time in minutes in the kiln;

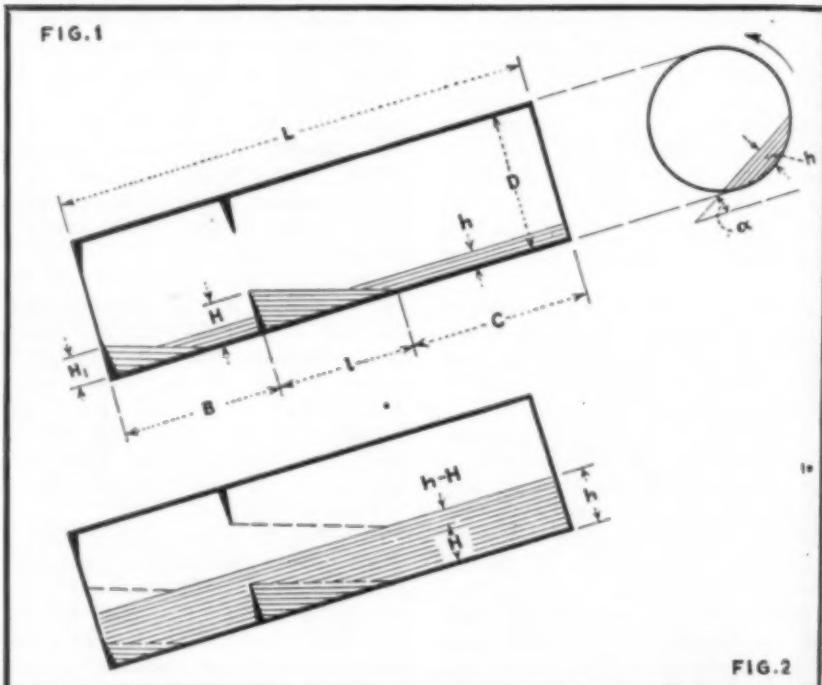


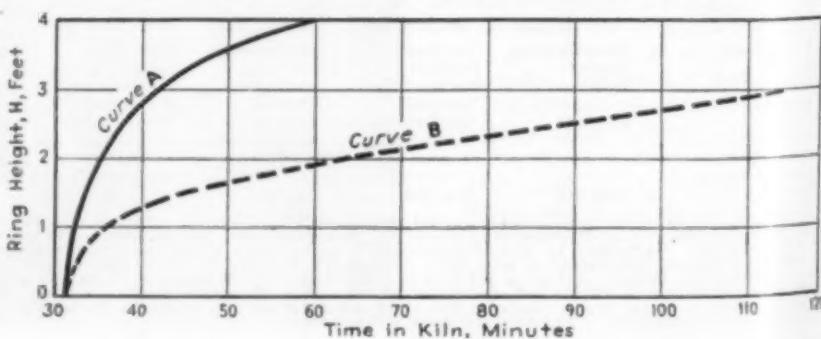
Fig. 1 — Rotary kiln cross section used in deriving general expression for time of passage through a kiln

Fig. 2 — How ring location and height of charge and ring affect time of passage through a kiln

α = angle the charge makes with the horizontal at the time it moves relatively to the kiln; D = inside diameter of the kiln, in feet; N = r.p.m. of kiln; S = slope of kiln, in inches per foot. (For example, $S = \frac{1}{2}$ in. per ft. where the slope is $\frac{1}{2}$ in. per ft.); and L = length of kiln, in feet.

From this equation, applying only to a

Fig. 3 — Curves showing effect on kiln passage time of increasing ring height; in Curve (A) h is kept equal to H , both increasing to 4 ft.; in Curve (B) h is held at 0.5 ft as H increases to 3 ft.



kiln of a single uniform diameter, without rings or dams, the general formula was developed as follows: In Fig. 1, h is the depth of charge, in feet, in that portion of the kiln where the charge is at a uniform depth. H and H_1 are heights of rings in feet. For the moment, omit H_1 from the picture. From inspection it is seen that here is the equivalent of two kilns, one a simple kiln of length $(L - l)$, diameter D and slope S ; and the other of length l , of partly conical shape with average diameter and slope depending on the relation of h to H . By finding these relations and substituting kiln of length $(L - l)$, diameter D and S in Equation (1), for the conical portion

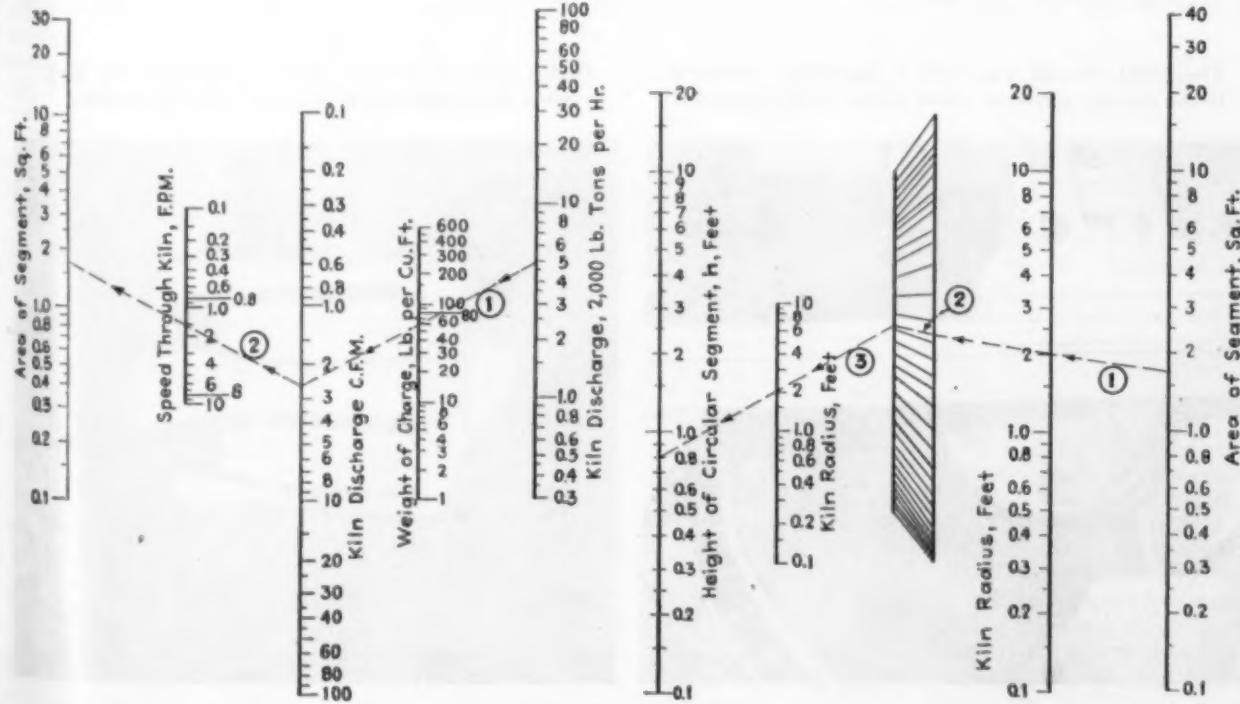
$$T = \frac{0.037(\alpha + 24)l}{(D - H - 0.5h)NS} \left(\frac{2h}{(Hh)^{1/2} + H} \right)$$

Fig. 4, Right—Nomograph solving Equation (1) for kiln passage time for a kiln without rings

Fig. 5, Left Below—Nomograph for determining kiln charge sectional area

Fig. 6, Right Below—Nomograph for determining height of kiln charge, h

These three charts show the rate of charge passage, time in the kiln, cross sectional area of the charge and charge depth, h . In the problem demonstrated the kiln is 4 ft. in diameter and 30 ft. long. Its slope is $3/4$ in. per ft. and its speed of rotation, 2 r.p.m. The charge is 5 tons per hour of 50 lb. per cu. ft. material, which has an angle of repose of 45 deg. In Fig. 4, following the numbered operations, lines are drawn from the angle of repose through the kiln slope to the turning line at the right, thence through the product of diameter \times r.p.m. to the rate of passage scale at 1.5 f.p.m. A third line from the last point through the kiln length gives the time in the kiln, 20 min. Fig. 5 uses the rate of passage just determined. A line is drawn from the kiln discharge rate through the bulk density scale to the scale for c.f.m., and a second line from this point through the passage rate scale to the charge sectional area scale at 1.7 sq. ft. Fig. 6 uses this last value. A line is drawn from the sectional area through the kiln radius to the central group of index lines, from which another line through the second radius scale indicates the height of a charge cross section, h , as equal to 0.8 ft.



as h approaches H , and is a minimum for a kiln with a single ring when $h = H$. When the ring is not at the discharge end, making h larger than H neither increases nor decreases the time in the kiln. An explanation for the reason may be had from Fig. 2 by considering $(h - H)$, the excess of h over H , as being supported on both sides of the dam and passing over it without being lifted. The portion H , equivalent to that shown dotted must, of course, be lifted and that is taken care of in the formula by making $h = H$. Therefore when h is equal to or greater than H , and the ring is not at the discharge end, inspection shows that the term $[(Hh)^2 + H]/h$ will always be equal to 2. Thus the formula for this particular case simplifies to:

$$T = \frac{0.037(\alpha+24)}{NS^2} \left[\frac{LS-12H}{D} + \frac{12H}{D-1.5H} \right] \quad (3)$$

2. When the ring is at the discharge end and h is greater than H , interchange h and H in the last expression of the general formula, Equation (2), making it $[(Hh)^2 + h]/H$ instead of $[(Hh)^2 + H]/h$. The reason this differs from Case (1) is that here there is no support beyond the dam for the portion $(h - H)$, so the whole charge must be lifted.

3. If there are two rings as in Fig. 1, treat as two kilns, one of length $(C+I)$ and one of length B , then add the time in each for the total time. If the dimension B is less than $12H/S$, and $(C+I)$ is less than $12H/S$, the formula will not give true results. In ordinary kilns, however, the dimensions are such that $(C+I)$ seldom has to be checked. It is well to check B as this varies with the flame and may be short.

In a kiln where a ring forms, if the fuel and draft equipment are elastic enough, it

may be profitable to increase h as H increases, keeping the two equal. Fig. 3 is an illuminating plot of the equation for a 10 by 140-ft. kiln at 2 r.p.m., with S at 4 in. and α at 36 deg., which strikingly brings out the time saved by doing this. The upper curve plots the time when h is kept equal to H , and the lower curve plots the time where a ring is allowed to build up with the feed held at a uniform rate. Increasing the kiln feed so that h keeps pace with H negligibly alters the heat transfer rate if the fuel consumption is proportionately increased, because the disadvantage of having a deeper bed through which to transfer the heat is compensated for by having a larger heat transfer surface, as h and the chord of the segment formed by the charge surface, change in approximately the same ratio.

To reduce the mechanical labor of using the kiln formula the nomograph, Fig. 4, gives the time and rate of travel through a

kiln with no rings. Fig. 5, with the travel rate taken from Fig. 4, and the quantity and unit weight of the charge, gives the section area of the uniform charge. Fig. 6, using the section area from Fig. 5, together with the kiln radius, gives the value of the height of the segment, h .

Space allotted here does not allow explanation of solutions for kilns having sections with two or more different diameters, or with rings that build up in thickness as well as depth. (In the above discussion the rings are considered to be of negligible thickness.) An understanding of the formula, however, will make its use possible for any combination of dimensions and any charging conditions.

In closing, acknowledgement is made of the help obtained from the work done and published in the Bureau of Mines paper already mentioned. It is doubtful if this formula could have been derived without it.

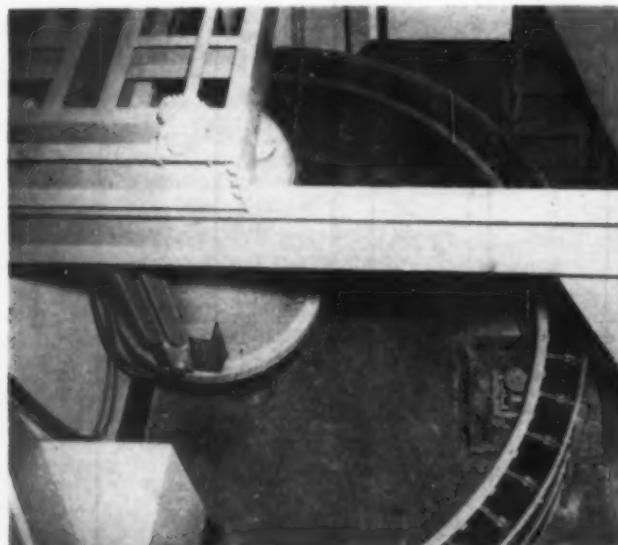
Loaded Ammunition

A RECENT issue of *The Ordnance Digest*, published by the Army Ordnance Department, describes progress that has been made during the War in the application of X-ray radiography to the inspection of shells loaded with TNT. Industrial 1,000,000-volt machines were installed at three ordnance plants under the jurisdiction of the Field Director of Ammunition Plants in early 1944. Similar units are to be installed at two additional plants, and 2,000,000-volt units, for the inspection of the largest shells, at two more plants. Before the introduction of X-ray the only method of examining for cavitation, porosity and foreign materials in the solidified bursting charge was to pour a certain proportion of split shells,

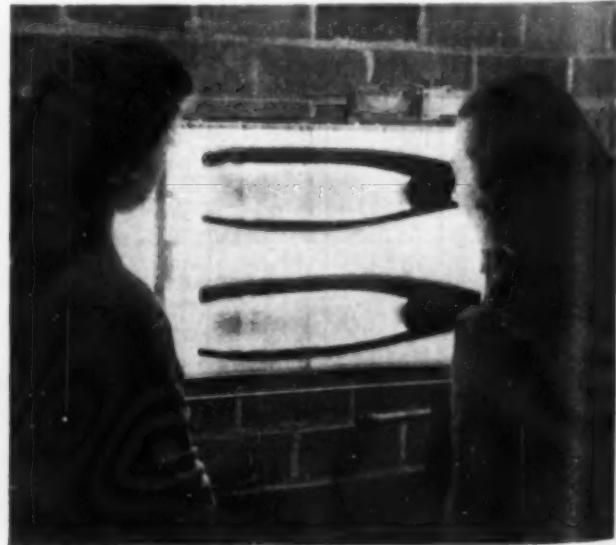
Inspected by X-Ray

which could be taken apart on cooling and the charge sawed lengthwise. Now, however, by use of high-voltage X-ray, which will detect voids in TNT even when surrounded by 2 in. of steel, it is possible to inspect 3,500 to 4,000 shells in 24 hr. with a single X-ray machine. The machine exposes shells continuously through the use of a ring conveyor holding 50 shells which rotates once in 18 minutes around the X-ray tube. The ring passes through the 18 in. concrete wall of the exposure room to the loading platform where the X-rayed shells and exposed film cassettes are removed and new ones added to the conveyor. Each shell is identified with its film so that those shown to be faulty can later be located.

The 1,000,000-volt X-ray tube is shown here centered in the circular conveyor which carries shells around it



High voltage X-radiation shows up defects in the TNT when the radiograph is inspected after developing



ECONOMIC FACTORS

Affecting Electrochemical Industries

Products now made by electrochemical operations are mainly basic industrial materials. The author points out that in the next decade we may confidently expect electrochemistry to move into more complex fields such as organic oxidation and reduction and provide the means for more readily producing new materials and at lower cost.—Editors

FUNDAMENTALLY all manufacturing industry is composed of the same general elements, seven in all, consisting of the five "M's," plant services and transportation. The five "M's" referred to are: management, money, men, materials and markets. While these seven factors are common to all manufacturing enterprises, the electrochemical industry has certain basic requirements and limitations which demand the employment of these elements in proportions different from non-electrochemical operations.

No electrochemical process in operation today is technically perfect. The perfect electrolytic cell has yet to be built and in fact nearly every electrochemical operation is performed based on technical compromises of some type. Each new plant which is built is an improvement over the old and the industry is constantly changing, improving and shifting.

It is fair to state that only comparatively few electrochemical processes have been operated long enough and developed to the extent that they can be duplicated and operated in another location without detailed technical research. There is, therefore, no standard electrochemical plant; each is custom built, specially designed for its purpose.

Products now made by electrochemical

operations are for the most part basic industrial materials—chlorine, alkali, chlorates, phosphorus, ferrous and non-ferrous metals. During the next decade we may confidently expect electrochemistry to expand into more complex fields such as organic oxidation and reduction, and provide the means of more cheaply and more readily producing new and profitable materials.

The part of management in electrochemical operations is by far the most important element, for upon management rests the choice of process, the selection of location, the securing of money, raw materials and labor, the proper merchandising and, most of all, the responsibility for profit or failure. This of course is common to management in all industry. However, unlike many other industries, the electrochemical industry gives management few alternatives. In the textile field, for example, if cotton goods are unprofitable, the mill may at comparatively little expense change to weaving rayon or mixtures or make heavier or lighter fabrics. Electrochemical plants, however, usually do not offer the opportunity to management to shift production to another product if one operation becomes unprofitable. Electrochemical operations, therefore, require that management be sound from the outset.

Financial requirements of electrochemical operations are usually heavy. The fixed investment required is usually larger than in non-electrochemical processes. For example, a chlorine-alkali plant producing a gross annual revenue of \$2,700,000 per year may cost anywhere from \$2,400,000 to \$4,000,000, depending upon the equipment used. It will require roughly \$1 invested for every dollar of annual sales. Electrolytic magnesium production is even more costly requiring about 75 cents of investment for each annual pound of production or roughly \$18,000,000 invested for \$5,000,000 annual sales, a ratio of \$3.60 invested for every dollar of annual sales. Contrasted with this is a typical non-electrolytic operation, the chlorination of hydrocarbon which will require an investment of about 70 cents per dollar of sales.

Reasons for the large capital requirements are easily understandable. In most electrochemical operations, power transmission, or power rectification is essential and the cost of such transformer and rectification equipment must be added to the cost of the actual process equipment. Most electrochemical processes require relatively low voltage and high amperage—and this necessitates a very substantial investment in copper conductors merely to carry the current to the point where the true electrochemical operation starts. Electrochemical process equipment is usually costly for it must not only withstand chemical attack but it must also conduct electric current properly and be insulated to prevent stray currents and destructive electrolysis.

Nearly all electrochemical processes produce co-products, some of which may have value and others which may constitute a disposal problem. In phosphorus production, for example, slag, carbon dioxide and ferro-phosphorus, all of which have comparatively little value, are obtained as waste or co-products, and plant facilities must be provided for disposing of these undesired materials.

In addition to the money cost for plant investment, maintenance in electrochemical processes may be very substantial. In chlorine-alkali operation, for example, chlorine, particularly when wet, is extremely corrosive and harmful to equipment. In electrothermal operation, furnace linings require replacement, hence in many electrochemical processes we must expect fairly high maintenance charges. In many cases this can be combated by the use of corrosion resistant equipment which frequently, more costly initially, decreases maintenance but adds to the capital investment.

While these operations frequently require high fixed capital, working capital requirements are usually somewhat lower than for comparable non-electrochemical processes for most electrochemical operations use comparatively less labor and the nature of many electrochemical products, chlorine, hydrogen, phosphorus, for example, precludes building large inventories of finished goods. Fortunately, too, the

From a paper presented in Chicago on January 19, before The Industrial Conference of the Chicago Section of The Electrochemical Society.

markets for electrochemical products with few exceptions are not subject to much seasonal variation.

To sum up electrochemical operations from the money standpoint:

1. Fixed capital investment is usually higher than in non-electrochemical operations.

2. Capital charges against operations are proportionately higher.

3. Working capital requirements are usually somewhat lower than in non-electrochemical industries.

The third "M" is men and this is unquestionably a major factor in successful electrochemical operation. While electrochemical processes generally do not require large quantities of labor, the quality is paramount. Good operators can make a mediocre operation successful or poor operators can break the best plant ever built. For establishing an electrochemical operation, therefore, the plant must locate where intelligent operators can be found.

With the exception of maintenance men and a few good electrical men, it is not necessary that skilled labor be employed for each electrical operation is usually so different that little experienced operating labor can be had and it is necessary, and probably better, to train the operator on the particular job he is to do.

Electrochemical operations are most unusual in that they entail two sets of hazards, dangerous to life and property. The electrochemical hazard involved in handling heavy direct current is serious and along with this are the chemical hazards of handling corrosive, flammable, or even explosive materials in the same equipment carrying electric current. Being skilled or having experience in electrochemical operations is not enough. Operators of these plants must be temperamentally stable and able to function intelligently when emergencies occur—and they always occur. Hence quality of labor is as great a factor in plant location as is quantity labor.

LABOR COST

While labor cost per unit of production may be less in electrochemical operations than in other chemical processes, nevertheless labor costs are appreciable and they may represent as much as 25 percent of the production cost, but usually lie in the range of 10 to 20 percent.

In planning the establishment of an electrochemical industry, labor rates must be given careful consideration since labor costs usually represent, next to raw materials and power, the largest cost element. As indicated previously, labor and labor costs may have a great influence on plant location for lower labor rates will tend to offset higher power costs and permit electrochemical processes to succeed even where power costs are somewhat higher. This is not in any sense a statement that

low labor rates are essential for electrochemical operation. However, since most electrochemical operations are operated 24 hours a day, 365 days per year, these industries usually offer year-round employment which is usually more attractive to intelligent operators than high hourly pay rates which may be offset by layoff periods.

MATERIALS

The fourth "M" is materials and by this is meant raw materials for the process and operating supplies. Raw materials and their location may drastically affect plant location and the establishment of an industry. Since electrochemical industries usually require high capital investment, they are set up for long term operation. To insure continued operation and to protect the capital investment, an assured source of uniform raw materials is extremely important. The best protection of supply which the electrochemical operator can have is to own his own raw material source. Failing this, electrochemical operation should not be undertaken unless raw materials are available in sufficient quantity and quality from a number of sources.

Some electrochemical processes such as those which produce or recover rare metals may be considerably handicapped by inadequate, uncertain or foreign raw material supplies. Until recently, lithium production was in this position. Likewise manganese, chromium and beryllium production is not entirely free from the handicap of importing ore from foreign sources. The possible large-scale production of metallic strontium likewise is not at present too attractive because of limited raw material supplies.

However, it is not enough to be assured of a raw material supply. This raw material should likewise be geographically located so that political, military, transportation or tariff factors cannot interfere with its regular delivery to the electrochemical plant at a fair price. The purchase of foreign raw material may entail carrying large stocks to insure against transportation delays and this in turn increases working capital requirements. The ideal would be to have the raw material supply located at the electrochemical plant.

Raw materials represent a considerable share of production costs in electrochemical processes but this percentage varies so widely that it is not possible to present accurate figures. Salt for chlorine-alkali operations may cost as little as 50c. per ton in the form of brine or as much as \$10 per ton or even more as dry salt delivered. It may represent 10 to 20 percent of production costs. Other more costly raw materials for other processes may exceed these ratios by a wide margin.

Many electrochemical processes are extremely sensitive to impurities or variations in quality of raw materials. In considering

the establishment of an electrochemical plant, therefore, the quality and uniformity of raw material must be carefully investigated and methods developed for controlling any variables in raw material analysis. Many electrochemical operations such as the production of alkalis, chlorates, perchlorates, peroxides and similar materials frequently use cyclic processes in which the electrolyte circulates continuously. Processes of this nature are particularly sensitive to impurities in raw materials since these impurities tend to remain in the circuit and accumulate. For example, one operation performed successfully for two years without process trouble, then suddenly went out of control. Detailed analyses revealed that over a long period small amounts of impurity in the raw materials had accumulated in the circulating electrolyte until a critical concentration was reached that upset the entire process. Electrochemical operations are particularly sensitive to trouble of this kind, hence it is extremely important that the raw material be carefully analyzed and controlled.

Here again it should be emphasized that the electrochemical industries are so new that there is much yet to be learned about the physical-chemical reactions which take place in an electrolytic cell under different conditions. These reactions when carried out with pure materials under laboratory conditions by competent technicians may appear relatively simple and controllable. But take this same process out in a plant, use 100,000-gal. tanks in place of glass beakers, use metallic, plastic or ceramic piping in place of laboratory glass tubing, employ non-technical men as operators, and the simple laboratory process becomes really complex—then just introduce a raw material which contains some impurity which was not anticipated, and anything can happen and does.

Unexpected or unanticipated impurities in raw materials are responsible for very many electrochemical process difficulties so the only safe procedure is to conduct pilot plant tests on the actual raw material to be used before building a commercial plant and these tests should be of sufficient duration to establish the cumulative effects of any impurities in the raw materials.

MARKETS

Fifth of the "M's" is markets, for a process, however interesting it may be technically, can justify investment of time or money unless the product can be sold at a profit regularly. So before attempting to establish an electrochemical operation, detailed marketing studies should be made to determine:

1. Whether a demand exists or can be created for the product.
2. Whether this actual or potential demand is large enough to support commercial production.

3. Whether this demand is increasing and permanent.

4. Where the markets are located.

5. What quantity can be sold.

6. At what prices it can be sold.

7. What competitive factors are involved, both from the standpoint of commodity and inter-commodity competition.

Marketing engineering is too often overlooked and yet it should actually be undertaken before plant design is started for it is to such studies that we must look for the answers to basic commercial questions. In establishing an operation of this kind, competitive factors should be given most detailed consideration. No market should be entered unless there is room to enter without disturbance and it should likewise not be entered unless one can compete, cost-wise at least, on equal terms. In the chemical and to some extent the electrochemical industry, inter-commodity competition is a most serious matter.

It frequently happens that several products will do the same job. For example, chlorine, hypochlorites, chlorates, chlorites, peroxides and permanganates are all oxidizing or bleaching agents and to some extent are mutually competitive. If, for example, one producer should decrease the price of peroxide, such price reduction would not only affect the other peroxide producers but it might also displace some of the other oxidizing agents in this field. Thus producers may not only compete with other makers of the same product but may also compete with entirely different materials.

Actual location of the plant will be greatly influenced by the location of the markets, and the proper placing of the operation plays an extremely important part in profits. To reduce this to its simplest terms, the ideal condition would be to locate the plant in the exact center of the market. To illustrate, in the accompanying Fig. 1 the market area, hexagonal in shape, is shown with the producing plant in the center and consumers located at each angle of the perimeter. This is the ideal condition assuming that all consumers purchase equal quantities. In Fig. 1 the distance to all consumers is six times the radius or $6R$. In Fig. 2, the total distance from plant to buyer is shown by

simple calculation to be $7.464 R$, or 24.4 percent greater than in Fig. 1. This difference in distances must be attended by difference in transportation cost and it may happen that this saving in the cost of getting the goods to market will more than offset other apparently unfavorable cost factors. This may be particularly true in those instances where the finished product is shipped in the form of a relatively dilute solution such as hydrogen peroxide or liquid caustic alkalis. The examples given, of course, are over-simplified but they are cited to show the importance of proper plant location with respect to markets.

PLANT SERVICES

The next factor affecting the establishment of the industry is plant services—water, steam, electric power. For the purpose of this discussion, we shall ignore water and steam for the electrochemical industries are little different from other chemical industries with respect to these two services. The requirement of large quantities of electric power, however, does specifically affect electrochemical industries and it is this service that has influenced the location of the industry very greatly and perhaps too much.

Whenever the layman thinks of electrochemical industries, he is naturally led to think in terms of plentiful and cheap power and of those locations where abundant and cheap power is or was available—Niagara Falls, the Tennessee Valley, Boulder Dam, the Bonneville system and so on. This reasoning is basically correct for it is a difficult matter for steam power to compete directly with steady hydroelectric installations. However, steam power is far from excluded for it has been demonstrated time and again that electrochemical processes can be very successful even though operated on apparently higher cost power.

The type of load will have considerable bearing on the plant location so far as power is concerned. Those industries using electrothermal processes and whose products may be stockpiled may operate very profitably on "dump" or seasonal power, by buying such power at low rates and operating at peak capacity while the

power is available and then shutting down or operating at low production rates when "firm" power only is available. The electro-thermal installations of the Keokuk Dam are good examples of this. At this point due to seasonal water conditions, power in large quantity is available for all but a few weeks in the year, yet the processes are such that they can take "outages" during low water periods. Electrolysis operations, on the other hand, usually cannot suffer such outages without deterioration of cells and other equipment.

The apparent higher cost of steam power is quite often more than offset by labor costs, raw material advantages, and transportation costs. And this brings us to the last factor affecting the establishment of an industry—transportation. Any product is useless unless it can economically be delivered to the point where it may be profitably used, hence transportation is of great importance in establishing an electrochemical industry. It seldom happens that raw materials, cheap power, low cost labor and markets are all found in the same place, hence in setting up our plant a balance must be struck between these four elements and in a country as large as the United States transportation costs play a large part. In fact, it has frequently been proved that it may be better to locate the plant nearer the market to save transportation costs even though it may require paying somewhat more for power.

HYPOTHETICAL PLANT

Now that individual factors affecting the establishment of an electrochemical enterprise have been considered, they may be put together graphically and for a hypothetical plant. In order to avoid narrowing discussion to a single product or a single location, a graphical presentation has been prepared on what might be termed a generic basis applicable to any electrochemical operation but which in fact is based on an actual process using electrolysis of a brine. In this graphic presentation, Fig. 3 and Fig. 4, are set up the major production factors, gross and net revenue as a ratio of gross annual revenue, and the following ratios were found to apply: gross revenue, 1,000; net revenue, 920; power cost, 207; labor cost, 114; raw material cost, 136; variable burdens, 197; and fixed charges, 171. These have been set up as ratios to allow comparison with other operations of different magnitude and these ratios have been plotted for 100 percent operation and all operating rates below that.

From this graph it is easy to analyze the various costs and revenue factors in their true relationship and in relation to gross profits indicated by the shaded area. First, all the cost factors have been set up cumulatively starting with the base of fixed charges. In this category are included the cost of management, the cost of money,

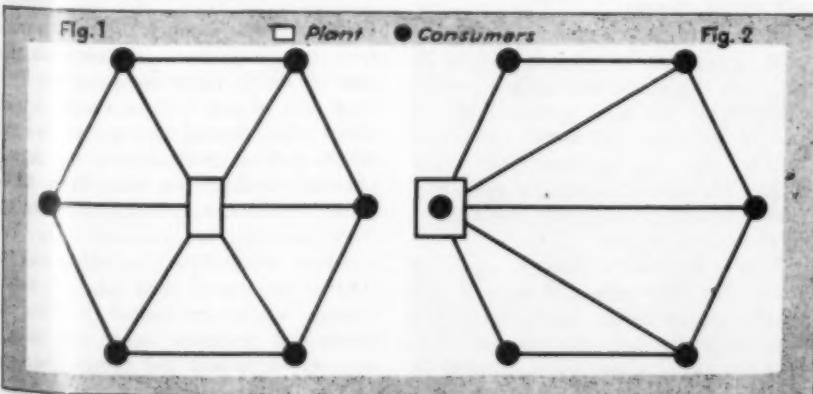


FIG. 3

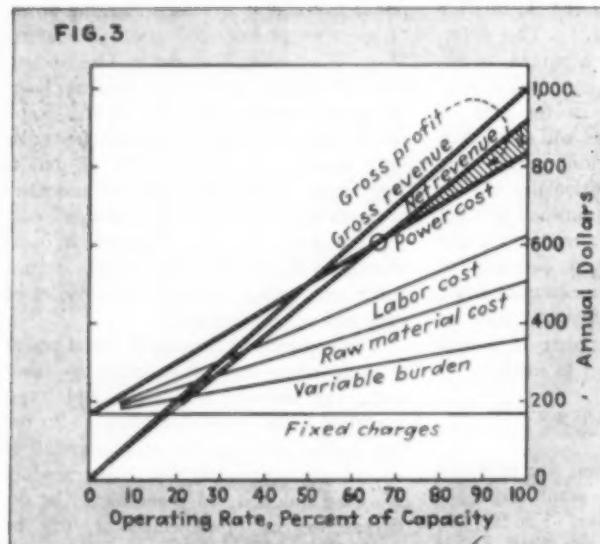
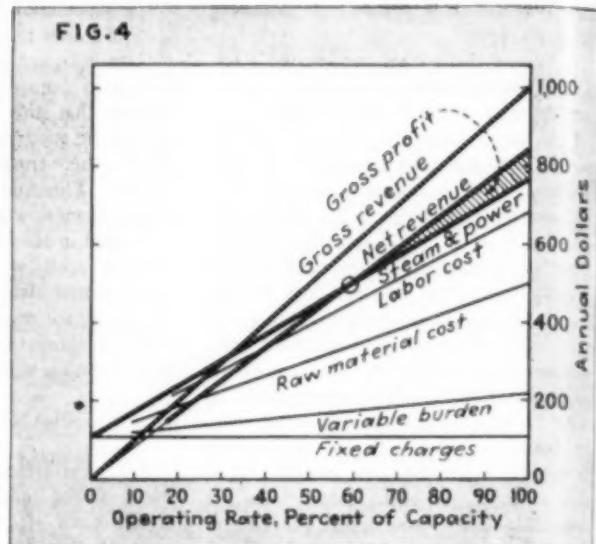


FIG. 4



Typical revenue and cost diagrams—Fig. 3 for electrochemical processes; Fig. 4 for chemical processes

property taxes and all other charges which do not vary with production. On this base has been superimposed the variable costs, raw material cost, labor cost and power cost.

Transportation of raw materials has been included in raw material cost. Transportation of finished goods and freight equalizations represent part of the difference between gross revenue and net revenue, the balance of this difference between gross revenue and net revenue being composed of selling and sales administrative expense, dealers' discounts and reserve for bad debts.

Looking at the factors which enter into costs, it becomes immediately apparent that while power cost is a major item, it is not much greater than the other cost components which are sometimes overlooked in establishing a plant site. Relatively small reductions in fixed charges, variable burden, raw material cost or labor, can easily offset slightly higher power rates. In this particular case transportation costs of finished goods and freight equalizations are small and selling expense is likewise low. However, reductions in these items would have the effect of raising the net revenue line and increasing the gross profit area. In a similar manner reduction in any of the cost elements will increase the gross profit area.

In this particular diagram, the crossover or break-even point appears to be at about 64 percent of the capacity of the particular operation. While the location of this crossover point is to some extent affected by the character of the particular business, it is more affected by the scale of operations and market conditions. If plant capacity is increased, cost reduction would be affected principally in fixed charges and this would have the effect of lowering all the cost elements on the chart, thus moving the crossover point to the left. Con-

versely, any reduction in operating rates or in net revenue would move this point to the right and decrease the area of profits.

OPERATIONAL DIAGRAM

Contrasting with this, Fig. 4 is a typical diagram for non-electrochemical operation. It represents graphically a chemical process, the chlorination of a coal-tar derivative which requires very little power but some process steam. Using the same method of applying ratios, the ratio to the various cost and revenue factors are: gross revenue, 1,000; net revenue, 851; steam and power cost, 92; labor cost, 176; raw material cost, 283; variable burden, 102; and fixed charges, 119. In this case fixed charges are lower than for the electrochemical process which must be expected. Variable burden is likewise smaller. Raw materials and labor costs are, however, much greater than in the electrochemical operation. Steam and power together are less than the power cost in the electrochemical process. Note, however, that the spread between gross revenue and net revenue is greater than for the electrochemical process, indicating higher selling expense, greater provision for advertising, bad debts and similar charges.

In this particular instance the crossover point appears at 54 percent of capacity, but again this is not necessarily a product characteristic but it is governed by the scale of operations and market conditions. Having now set up somewhat similar diagrams for an electrochemical and a non-electrochemical process, they may be compared factor by factor.

Fixed charges—As was pointed out earlier, the electrochemical industry will usually require higher capital investment than the purely chemical operation. This need not handicap the electrochemical operation, however. These fixed charges repre-

sent, among other items, the cost of money. The trend in recent years has been toward lower interest charges. If this continues it will tend to reduce fixed charges. Recently, considerable improvement has been made in power conversion equipment, first to provide more kilowatts for a longer time for the same or less money, and, second, to improve the availability so that less standby equipment is needed. This together with the development of better and more resistant process equipment will tend to reduce the depreciation factor in fixed charges.

Variable burden—This is composed of a number of items directly related to the individual process and product, such as electrode and container costs and it is therefore, not possible to make a direct industry comparison. In the particular examples chosen, these costs are higher for the electrochemical industry mainly because of electrode consumption and miscellaneous supplies.

Raw material costs—Usually the electrochemical industry has the advantage here since most electrochemical products are made from relatively cheap raw materials. With the exception of the so-called heavy chemicals, other chemical operations usually require more costly raw materials. Electrochemical products are usually made from natural primary raw materials, the cost of which varies comparatively little from year to year. Those chemical operations which depend upon process raw materials such as intermediates for organic chemical synthesis are more likely to be subject to fluctuating supply and demand forces affecting raw material costs.

Labor costs—The electrochemical industries because of their inherent nature usually require mechanical handling of goods and processes, hence one usually sees very little pick and shovel labor em-

(Continued on page 114)

PYROTECHNIC COMPOUNDS

Attain Large-Scale Production

Volume production of pyrotechnic compounds of military importance has rested in the hands of comparatively few manufacturers in this country. During the early war years they were confronted with the necessity of starting from scratch and emerging immediately into volume production. Trials and tribulations were many but rigorous production demands were met, but always with adequate safety precautions.—Editors

PRODUCTION volume of pyrotechnic compounds has pyramided the last few years due to vastly increased wartime demands. This increased rate of activity has required solution of numerous problems for which previous answers were unavailable. Hazards involved and rigid performance requirements have thwarted to some extent application of the usual chemical engineering mechanized unit operations. Manufacturing exigencies have permitted little time and effort to be expended upon development work. The quickest and simplest methods at hand have been pressed into service to meet the ever-spiraling military demands. Mixing phases of processing have utilized hand processing in batch quantities at critical steps. In all steps of this nature the operator is fully protected with adequate safety equipment.

Processes in use at United States Flare Corp., foremost western producer of this class of compounds, have developed under pressing demands during the past four years under the guidance of James M. Hoyt, Jr., president. Production of this organization has attained a value of \$500,000 monthly and the products range from signal flares to smokes and other like products. Many ingenious devices contrived during the early period of growth and which had every appearance of makeshifts have undergone the necessary improve-

ments to reach the status of capable tools of production. Only through such transition has it been possible to attain the present rate of smooth, continuous, volume production.

The vital part of each product manufactured is embodied in the pyrotechnic compound which exists in each unit as a pressed pellet. Compounds are produced by the dry mixing of from five to eight chemical ingredients. The chemicals must adhere to rigid specifications not only from the standpoint of purity but mesh size as well. In like manner the performance of the final product must conform to exacting specifications for candlepower, burning time, and color. A typical formula for a green flare consists of: barium nitrate, electrolytic copper dust, potassium perchlorate, powdered magnesium, and linseed oil. Variations of from 1 to 3 percent from the standard formula are allowed for various of the chemicals. This latitude is

necessary to meet the strict performance requirements.

Prior to compound production it is necessary to coat the powdered magnesium with linseed oil. The latter serves as an anti-oxidant. This operation is accomplished either by use of a coating drum or by hand processing. With the latter method 50 lb. of magnesium are added to an open mixing tub. The required amount of linseed oil is then added and the operator proceeds to work the batch by hand. This is followed by working the magnesium through 30 mesh grounded copper screens into another tub. Screening is repeated several times after which the coated magnesium is spread on trays which are placed in a dryer building. This is essentially a tunnel dryer in which heated air controlled within a narrow temperature range flows over the magnesium. Drying time consists of approximately two days.

In production of compounds the neces-

Hand mixing apparatus consisting of tubs and grounded copper screens used for attaining the intimacy of contact necessary with pyrotechnic compounds



sary chemicals comprising a 50-lb. batch are weighed and screened by hand through 30-mesh screens into a mixing tub. This serves to break up lumps of hygroscopic material. Hand-mixing then follows with subsequent screening and re-screening through screens of larger mesh size, the maximum being used is that of 8 mesh. This simple operation serves to give the intimacy of contact and uniformity of mix so necessary for satisfactory performance during ignition. Due to varying specific gravities of the different chemicals anything but gentle mixing operations results in particle separation. Early work with mechanical mixers in various parts of the country disclosed that use of closed type mixers introduced explosion hazards. Open type paddle mixers introduced frictional hazards not to mention cleanliness problems with the exposed mechanisms. Safety factors limited operations to small size batches to the extent that hand mixing has proved simpler, faster, and more efficient than attempts which were made in the field of mechanical operations. Prolonged development work would undoubtedly lead to continuous mixing by mechanical methods with small concentration of compound existent at any one instant during the time of hazard. Production needs for the period however have been ably met by the present methods.

During the early period of growth of the organization testing of the few batches of composition which entered daily production was comparatively simple both from the standpoint of chemical analysis and performance tests. Spiraling production soon resulted in a large volume of such testing. Simplification of this was obtained by pressing a rotary blending drum into service. Comparison tests on individual batches before blending and afterwards on the blend disclosed that this operation could be used satisfactorily providing the

drum was operated at low speeds and imparted a folding action rather than one of throwing. The blends retained the close limits required in performance tests. In this manner 250 lb. of compound were blended into one lot after the intimacy of contact had been gained in the 50-lb. batch by hand mixing. The operation was housed in a building surrounded by earthen baffle walls at a safe distance from other buildings in the plant. In operation for over a year no difficulties were experienced with this method of blending. With further building expansions which crowded into the isolation area established for blending, it was decided to abandon this step in the interests of greater safety. At present the blending method makes use of raking apparatus in which the product is exposed and the hazard has been reduced to one of fire rather than that of explosion under confinement.

After blending, the compound is stored in individual 50-lb. containers in dehydrator buildings where relative humidity is maintained in the zone of 20 percent. Many of the chemicals entering the compounds are hygroscopic by nature and addition of moisture vastly alters the performance characteristics of the completed unit.

After a required period of aging the composition passes into other phases of operations which have been completely mechanized thereby attaining continuous production. The composition is automatically weighed into pellet charges which pass to continuous presses in which the charge is pressed into aluminum cups. The pyrotechnic pellet then passes to assembly operations to be combined with other devices which enter into the functioning of the completed unit.

Rigid control is maintained throughout the plant on all phases of processing. Raw materials; mixed compounds; all are subjected to chemical analysis for specification

conformance. Performance tests are carried out not only on the compound blends but the finished lots as well before application of government acceptance tests. Only through rigorous observation of such essentials has the organization been able to achieve volume production of high-quality products which have played a vital part in military campaigns throughout the world.

Early day problems which at the moment seemed baffling and greatly hindered productive efforts were nevertheless of deep interest. Typical was the case of two manufacturers' same grade of powdered magnesium. Each conformed to the rigid chemical and physical specifications. One however resulted in an extremely short burning time when compounded into the pyrotechnic. Microscopic examination disclosed that one manufacturer was evidently granulating his product by a different method from that used by the other. The fast burning magnesium when viewed microscopically consisted of a nucleus with jagged, splintery ends protruding; the other possessed a blunt and compacted appearance. Although supposedly identical the one was consumed in the reaction in approximately half the time of the other. Other difficulties evolved around the loss of color in the compounds when stored over any great length of time; alteration of performance characteristics by moisture pick-up in storage. Difficulties were many but in each instance a thorough study was made, correctives applied, and production gradually became smooth and continuous.

Similar to other industries which have started from scratch during the war emergency the growth of U. S. Flare Corp. has added an interesting chapter to the production potentialities of our country which when unleashed and subjected to the dominating drive of American will and ingenuity come through with the goods in spite of all obstacles.

Tunnel dryer building where oil-coated magnesium powder is dried with warm air. Temperature is controlled within close limits. Trays slip in and doors pull shut



Rotary blending drums have been replaced by raking apparatus for blending the 250-lb. batches. Operator is fully protected by safety clothing while mixing



Wet-Strength Papers For Modern War Maps

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Preeminent among the several types of wet-strength paper is the paper on which combat maps are printed for our armed forces. Through all the water, oil and mud of the battlefield these maps remain strong and opaque, can be washed when dirty, can be written upon while soaking wet. Seen in retrospect, the performance of war maps will serve to suggest to the engineer a host of possibilities for products possessing properties never before associated with anything made of paper.—Editors

changed some of the other properties of the paper to limit its usefulness, were limited in their application, or provided small or temporary benefit. The recent development of wet-strength technique consists of: the use of modern, bleached, sulphate-cooked wood fibers of great strength; the application of the latest technique in offset paper manufacture; and the controlled addition of certain resins.

The wet-strength characteristics of war-map paper as originally developed were obtained with melamine-formaldehyde. Although urea-formaldehyde resins are also used to impart wet strength to some papers, the melamine resin is employed by practically all the manufacturers of war-map papers. The preparation and application of melamine resins are not complicated and require neither extensive special equipment nor changes in normal manufacturing procedure. Results are obtained with a minimum amount of material, and the benefits are lasting. The resin, normally in the form of a fine white powder, is prepared by dissolving it in a mixture of warm water and hydrochloric acid and allowing the solution to age for a few hours. When the acid-treated resin ages, preliminary polymerization takes place and the colloidal particles formed are positively charged. Cellulose fibers are negatively charged and when the resin colloid is mixed with the water suspension of fibers, it attaches itself to the fibers almost instantly.

Most important factor in the use of melamine resin involves the addition of the solution at the proper point in paper manufacture. Best results are obtained

by adding the solution to the stock at some point between the screen where coarse matter is filtered out and the point where the stock flows onto the wire. Excellent results are obtained by adding it to the stock as it enters the head box. When the sheet is formed, the resin binds the fibers together and becomes insoluble as the heat applied to dry the paper accelerates the polymerization and cures the resin. Resin requirements for wet-strength treatment in general vary according to the uses of the paper. About 2.5 to 3 percent is required for map paper and that is about the upper limit for efficient use.

A definite measure of some of the benefits of the wet-strength treatment can be obtained by comparing, in the accompanying table, some of the physical properties of papers with and without resin.

These papers were made with a minimum of mechanical beating of the fibers in their preparation for felting. By increased beating—and hence the increased gelatinization of the fibers—the dry strength of the control paper could have been developed almost to that of the treated paper. However, excessive gelatinization as a means of attaining maximum strength has important disadvantages in addition to power consumed in the beating operation. Gelatinization of the fibers affects adversely the expansivity, distortion, curling, and ink receptivity—properties which are scarcely affected by the resin.

For the duration of the war, no appreciable development in the manufacture of resin-bonded papers for civilian use is to be expected. However, in the future, we may expect the use of resin to improve greatly the performance of papers for many everyday uses. Among the products already under consideration are: paper towels that function when wet without linting or falling apart; wrappers that will carry wet vegetables and meats and hold frozen foods indefinitely under moist conditions; grocery bags that will hold wet articles. Other promising grades are papers for multiwall bags, blueprint and brownprint papers, lens tissues and other wiping papers, outdoor advertising papers, field note books and plane-table papers, hanging papers, barrel liners, and boxes.

Effects of Melamine-Formaldehyde on Properties of Map Paper

	Control Paper, No Resin Added	Wet-Strength Paper, 3 Percent Melamine- Formaldehyde Added
Thickness, inches.....	0.0048	0.0047
Bursting strength, points:		
Dry or normal.....	24	54
Wet*.....	5	25
Tensile strength, kg. per 15 mm. width:		
Dry or normal, Mach. direction.....	7.3	12.9
Cross direction.....	4.0	8.0
Wet*.....	1.0	4.3
Cross direction.....	0.6	2.7
Tearing strength, grams:		
Dry or normal, Mach. direction.....	175	110
Cross direction.....	186	116
Wet*.....	82	246
Cross direction.....	86	256
Folding endurance, M.I.T. double folds:		
Mach. direction.....	264	1800
Cross direction.....	67	1420

* Paper immersed in water for one hour which is sufficient time for saturation.

Graphical Solution of Friction Loss Problems in FLUID FLOW

To eliminate the "backbreaking" mathematics involved in the method ordinarily used to solve problems of pressure drop due to friction, the author has prepared three graphs which reduce the calculations to the simple multiplication of three factors. Accuracy of the method is well within the limits of practical operations.—*Editors*

TO FACILITATE the practical determination of liquid friction loss in round pipes, three graphs have been prepared. These reduce pipe friction calculations to multiplication of three factors, namely: (1) head loss for liquids in clean steel pipe having a kinematic viscosity of 1.1 centistokes; (2) viscosity factor to correct for other viscosities; (3) roughness factor to correct for other types and conditions of pipe. The three factors are obtained from Figs. 1, 2, and 3, respectively, and provide a means for simple, rapid solution of friction loss problems.

Fluid friction loss in pipes is usually determined by means of one of the following equations:

$$h = 0.2083 \left(\frac{100}{C} \right)^{1.88} \frac{Q^{1.88}}{D^{4.88}} \quad (1)$$

$$f = 772 D \Delta P / L \rho V^2 \quad (2)$$

Equation (1), a convenient form of the widely used empirical formula proposed by Williams and Hazen¹, applies only to water at about 60 deg. F. or to any other liquid having a kinematic viscosity of about 1.1 centistokes.* For design purposes the commonly used value of C for clean steel pipe is 100.

For fluids in general, Equation (2) or the Fanning equation² is more convenient. The friction factor *f* depends upon the

Reynolds number, *Re*, whose value is:

$$Re = 124 D V \rho / \mu$$

When the Reynolds number is calculated, the friction factor *f* is read from a chart^{3, 4} and then used in the Fanning equation (2).

These methods are tedious and time-consuming, especially when frequent calculations must be made.

It will be observed that Fig. 1, which was prepared from friction factor curves^{5, 6} and the Fanning equation, relates three factors—volume rate of flow in g.p.m., nominal pipe size, and friction loss per 1,000 ft. of clean steel pipe. From any two factors the other one may be obtained. The graph correctly reflects the dimensional formula within about 2 percent for a viscosity of 1.1 centistokes.

The viscosity factors given in Fig. 2 are average figures calculated by means of the Fanning equation and are used to correct values from Fig. 1 for liquids having viscosities other than 1.1 centistokes. Thus, if a 3-in. clean steel pipe carries a liquid having a viscosity of 20.6 centistokes at the rate of 160 g.p.m., the friction loss per 1,000 ft. of pipe is: $63 (H, \text{ from Fig. 1}) \times 1.72 (F, \text{ from Fig. 2}) = 108.4 \text{ ft. of liquid}$.

Results obtained by use of Fig. 2 agree with calculated values with a probable error usually less than 5 percent. Uncertainties in the value of the friction factor *f*, as well as the effects of design approximations and structural faults in the system, are sufficient to obscure the errors involved in using the graphical method.

It is often convenient to apply roughness factors to the values given in Fig. 1 for obtaining approximate friction losses in other types and conditions of pipe.⁶ These are shown in Fig. 3. For example, if instead of clean steel pipe, 11-yr.-old castiron pipe is used, then the head loss from Fig. 1 is multiplied by 1.5.

Thus, the solution of friction loss problems by the rigorous Fanning or Williams-Hazen equation is simplified by use of:

$$H_a = H \times F \times R \quad (3)$$

or

$$P_a = H_a \times \text{sp.gr.} \times 0.433 \quad (4)$$

NOMENCLATURE

<i>C</i>	Constant depending upon the type and condition of the conduit
<i>D</i>	Inside diameter of pipe, in.
<i>f</i>	Friction factor, dimensionless
<i>F</i>	Viscosity factor, dimensionless
<i>h</i>	Pressure drop, ft. of liquid per 100 ft. of pipe
<i>H</i>	Pressure drop, ft. of liquid per 1,000 ft. of clean steel pipe for liquids having a kinematic viscosity of 1.1 centistokes
<i>H_a</i>	Pressure drop, ft. of liquid per 1,000 ft. of pipe. For any type of pipe or viscosity depending upon the factors used
<i>L</i>	Equivalent length of pipe, ft.
ΔP	Pressure drop, lb. per sq. in.
<i>P_a</i>	Pressure drop, lb. per sq. in. per 1,000 ft. of pipe. For any type of pipe or viscosity depending upon the factors used
<i>P</i>	Density of fluid, lb. per cu. ft.
<i>Q</i>	Rate of flow, g. p. m.
<i>R</i>	Roughness factor, dimensionless
<i>Re</i>	Reynolds number
μ	Absolute viscosity, centipoises
<i>V</i>	Average linear velocity, ft. per sec.

Use of the proposed graphical method is illustrated in the following examples:

(a) A 6-in. best castiron pipe is to carry a liquid (sp.gr. 1.32) having a kinematic viscosity of 15.7 centistokes at the rate of 600 g.p.m. What will be the friction loss in feet of liquid and in lb. per sq.in. per 1,000 ft. of pipe?

For the solution, the three graphs are used to determine the three factors in Equation (3). Thus, $H = 24.0$ (from Fig. 1); $F = 1.65$ (from Fig. 2); and $R = 1.15$ (from Fig. 3). Therefore, according to Equation (3) $H_a = 24.0 \times 1.65 \times 1.15 = 45.54$ ft. of liquid per 1,000 ft. of pipe. And according to Equation (4) $P_a = 45.54 \times 1.32 \times 0.433 = 26.0$ lbs. per sq.in. per 1,000 ft. of pipe.

(b) Water at 60 deg. F. (viscosity = 1.1 centistokes) is to flow through the equivalent of 1,000 ft. of clean steel pipe at the rate of 150 g.p.m. A head of 20 ft. is available. What must be the pipe diameter?

For the solution of this problem, Fig. 1 may be used without calculations, since the

* Kinematic viscosity, centistokes = absolute viscosity, centipoises/sp. gr. referred to water at 60 deg. F. as unity.

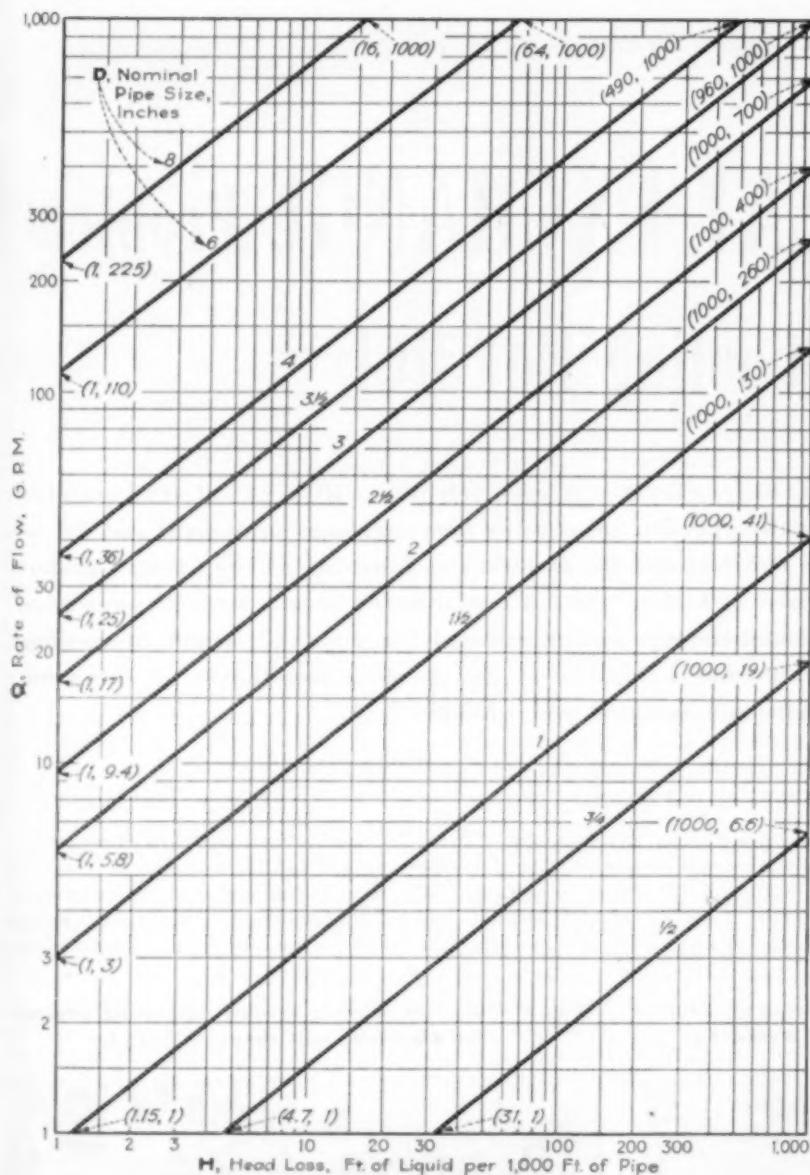


Fig. 1—Relationship between head loss due to friction, rate of flow, and size of pipe. Head-loss values are correct only if kinematic viscosity is 1.1 centistokes and pipe is clean steel; get viscosity correction factor from Fig. 2 (below) and get pipe correction factor from Fig. 3 (upper right)

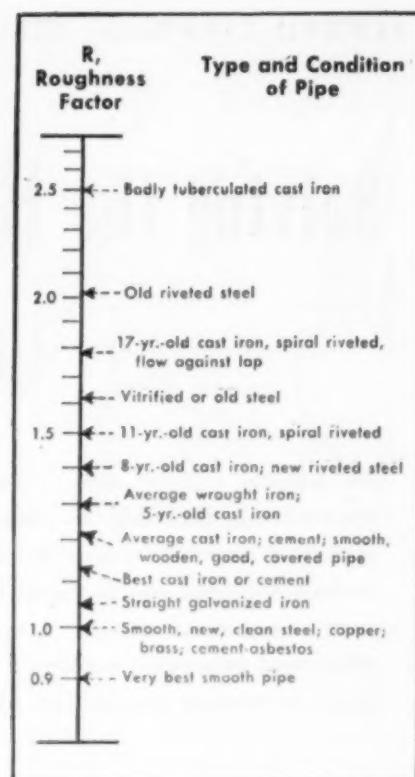
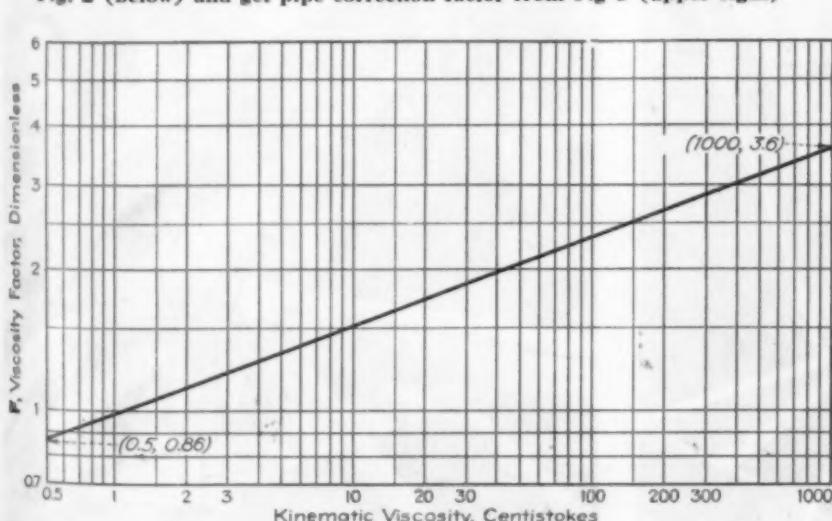


Fig. 3—Roughness factor, to correct head loss obtained from Fig. 1 for various conditions of pipe

type of pipe and viscosity are correct. It is seen that, on Fig. 1, the point, 20 ft. head loss and 150 g.p.m., lies between a $3\frac{1}{2}$ and 4-in. pipe. The 4-in. pipe is larger than necessary. However, the total head lost in the $3\frac{1}{2}$ -in. pipe at 150 g.p.m. is 27.0 ft., or more than the available head. Hence, $3\frac{1}{2}$ -in. pipe is too small, and 4-in. pipe must be used.

(c) A liquid having a kinematic viscosity of 10 centistokes is to flow through the equivalent of 1,000 ft. of average wrought iron pipe at the rate of 200 g.p.m. A head of 20 ft. is available. What must be the pipe diameter?

In order to be able to use Fig. 1 as above H must first be solved for by means of Equation (3). The known elements in Equation (3) are: $H_0 = 20$ ft. available head (given); $F = 1.5$ (from Fig. 2); and $R = 1.3$ (from Fig. 3). Substituting these values in Equation (3), it is found that $H = 20/(1.5 \times 1.3) = 10.3$ ft.

Referring to Fig. 1, the point, 10.3 ft. head loss and 200 g.p.m., lies between 4 and 6-in. pipe. Hence a 6-in. pipe must be used.

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ALFRED LIPPMAN, JR. *Plant Manager, Bay Chemical Co., Inc., Weeks, La.*

Solving the HEAT EXCHANGE Problem In Cooling Hot HCl

To handle continuously a large daily tonnage of relatively weak HCl gas at temperatures approaching 800 deg. F. placed heavy burden on existing heat exchange equipment and led to extensive tests of various metallic and non-metallic materials of construction. Impervious graphite-base material was installed because of higher rates of heat transfer, greater strength and resistance to corrosive attack. A new trombone-type cooler reduced the required length of cooling tubes and consequent ground area to only a fraction of the previous installation, at the same time permitting production of more concentrated acid.—*Editors*

THROUGHOUT the chemical and process industries, the selection of suitable construction materials was a critical problem long before the present war, and will probably continue as such into the post-

war world. The Bay Chemical Co. has applied a relatively new material in the construction of process equipment and thereby favorably affected quantity and quality in its production of muriatic acid.

In the operation of its Hargreaves process acid and salt cake plant at Weeks, La., the Bay company produces continuously a large tonnage of relatively weak hydrogen chloride gas which leaves the producers at

Fig. 1—Top view of 140-ft. long trough-type glass-tube unit used in cooling muriatic acid at Weeks, La.



Fig. 2—Side view showing wooden supporting structure for glass-tube unit shown in Fig. 1.



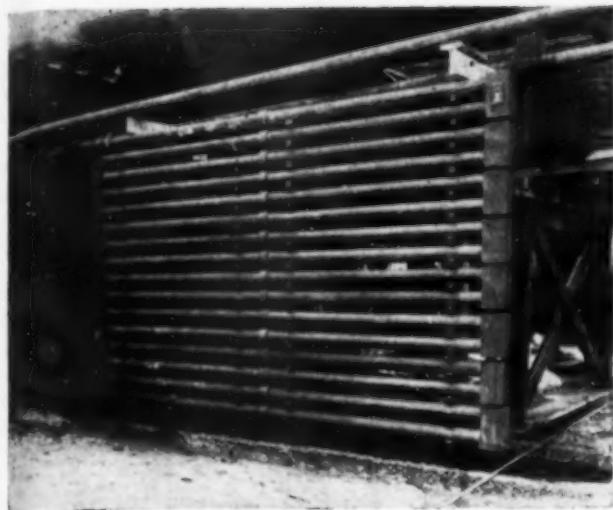


Fig. 3—Original experimental unit with single bank of Karbate tubes 3 in. I.D., 12 ft. long by 16 rows high

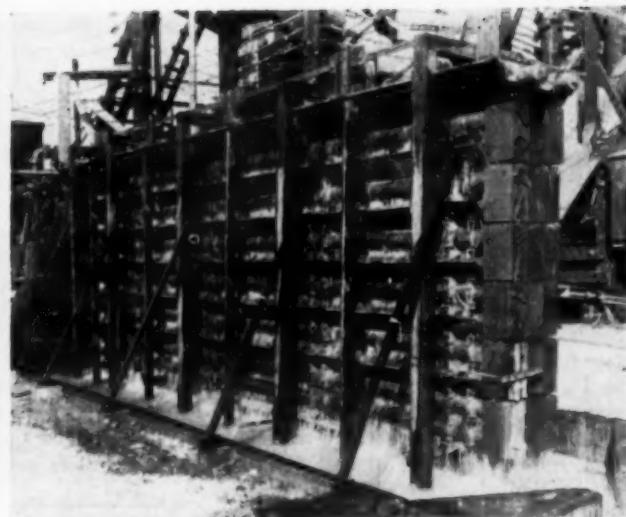


Fig. 4—Double unit cooler constructed of 4 in. I.D. pipe with block-type return bends

temperatures up to 800 deg. F. and in concentrations in the order of 7 to 20 percent HCl by volume. This gas must be cooled and the HCl dissolved in water in order to produce up to 20 deg. Bé. muriatic acid. A large plant is required, with circulation of hundreds of gallons per minute of acid through towers and coolers in order to provide adequate contact between the gases and liquids, and to remove sensible heat from the gases as well as the heat of absorption of the hydrogen chloride from the liquid. Acid at the exit of the strong acid tower must be maintained at temperatures as low as 90 deg. F. at certain times.

The original plant was incapable of producing acid at a concentration greater than 18 deg. Bé. due to the lack of adequate cooling and circulating facilities. Glass heat exchangers were employed, but the relatively low thermal conductivity of this material limited the over-all heat transfer coefficients to between 15 and 30 B.t.u. per sq.ft., hr., deg. F. The handling of such large volumes of acid under these conditions required unusually large installations of cooling and circulating units and still held production to 18 deg. Bé. acid.

Certain characteristics of these units and of the manufacturing process then employed militated against the satisfactory use of these heat exchangers. Up to four years ago, minute traces of hydrogen fluoride were evolved from certain refractory cements used in the plant, and this, of course, attacked the glass, decreasing its thickness, which, coupled with crystallization after one or two years, caused the glass to become brittle and easily broken. After substantial crystallization or solution in HF had set in, sensitivity to pressure greatly increased, so it was inadvisable to subject this equipment to any but low-gravity pressure. For this reason it could not be placed at the pump discharge level because of the

pressures involved from friction drop and static head to the tops of the 80 ft. absorption towers.

There was no substantial benefit in operation of glass coolers with acid velocities in excess of 1 ft. per sec. because at that maximum velocity, the film resistances to heat flow became very small in comparison to resistance of the glass itself. There were required large volumes of acid over absorption towers in order to keep down the temperature rise therein; therefore with the low-optimum velocity through glass tubes, three tubes in parallel were required for each trough in order to utilize heat-exchange surfaces efficiently. The low velocity also resulted in increased sedimentation of solids—creped rubber, dust, caulking materials from the towers and gas lines, etc.—which were carried over into the acid stream. Some of these solids crystallized out in the coolers and became so firmly cemented to the glass tubing as to reduce heat transfer and to exert greatly uneven tensile stresses on the tubing—another factor unfavorably influencing the tendency for breakage. These factors combined were such that breakage of one or more tubes occurred commonly upon starting up or shutting down a cooler even with the low gravity heads involved of as little as 6 ft. of acid.

A few years ago it was decided that the plant should produce a stronger acid, but it was felt that the inherent problems encountered in adapting glass heat exchange equipment to the manufacture of 18 deg. Bé. acid would have been magnified and increased many times over in the manufacture of a 20 deg. acid. Much larger volumes of acid would be needed for circulation in order to reduce the temperature rise within the absorption towers. In addition, a tremendously increased cooling surface would be essential to provide lower acid temperatures required to make the stronger acid and to compensate for the

lower temperature differentials that would then exist between the acid and the cooling water. For example, an 8 percent HCl gas is in equilibrium with 20 deg. acid at 101 deg. F., whereas the acid temperature may be allowed to rise to 139 deg. F. to be in equilibrium with 18 deg. acid—a difference of 38 deg. F. which profoundly affects the temperature differential, hence the required surface area of the heat-exchange equipment.

In seeking a more suitable material of construction for the cooling system, a number of metallic and non-metallic materials were investigated. Ceramic heat transfer equipment is subject to substantially the same limitations as glass. An acid-proof elementary metal such as tantalum definitely meets the heat-exchange requirements, but the cost to handle the required acid volume was thought to have been prohibitive. Acid-resisting alloys showed excessive rates of corrosion, particularly at the velocities encountered. Accordingly it was decided to investigate the possible use of Karbate, the impervious graphite-base material developed in recent years by the National Carbon Co.

To provide a basis for these comparisons, data were first obtained on a single typical glass tube cooling unit of the tube-in-water-trough type which was actually in operation at the plant. Each heat-exchanger trough was 140 ft. long by 2½ ft. deep by 6 ft. wide and contained 720 ft. of 3-in. I.D. borosilicate glass tubing. The average coefficient of heat transfer determined was 25 B.t.u. per hr., sq.ft., deg. F. The cost of a complete double-decked unit was about \$1,600. The construction of the unit was of the familiar type with each 6-ft. length of glass tubing bound to the adjoining lengths by means of rubber stoppers and glass sleeves with metal flanges and bolts. It was estimated that the wooden trough and supports would have a life close to 15 years, but previous

experience had shown that the glass tubing lasted a maximum of 3 to 4 years.

When comparable data were obtained for Karbate equipment it was decided to install this material in a cooling unit of the trombone type consisting of 12 rows of 4 in. I.D. x 5½ in. O.D. pipe, each row 24 ft. long, representing a total of 288 linear feet of pipe. Each 24-ft. length was assembled of four standard 6 ft. lengths with standard graphite-base couplings, connected at each end to block return bends equipped with removable plugs (see front unit of the double cooler shown in Fig. 4). Water flowed freely under gravity over and down the exterior of the tubes, with acid flowing through the tubes. The over-all coefficient of heat exchange of the Karbate cooler was approximately 300 B.t.u. per hr., sq.ft. and deg. F.* or 12 times that of the glass heat exchangers. In other words, it would have required 15 to 20 times the length of glass tubing in the cooler to have performed the same job and this would have required a ground surface area 50 times larger. The cost of the glass installation would have been just three times that of the graphite-base cooler.

Furthermore, the mechanical strength of the new coolers was much greater. They proved able to withstand all pressures encountered at pump discharges, up to 70 lb. per sq.in. and remained unaffected by considerable mechanical shock. Inasmuch as carbon and graphite-base materials are inert to most acids and alkalis, the coolers could not be affected by traces of hydrofluoric acid. Their greater strength also removed one of the most serious restrictions in design since it now became possible to employ a cooler with a truly economic balance between power (pumping) and water costs on the one hand and equipment and maintenance costs on the other.

The change from the original experimental use of 3 in. I.D. graphite-base pipe to the 4 in. I.D. of later design with longer lengths of pipe in straight runs has greatly reduced friction drop. Each unit has been hooked directly to pump discharge, maintaining fluid velocity at a sufficiently high rate 5-9 ft. per sec. to defeat the problem of sedimentation experienced

Comparative Performance Data for Heat-Exchange Equipment in Cooling HCl

Specification	Glass Equipment	Graphite-base Equipment	Graphite-base to Glass Ratio
Floor space, sq.ft.	840	78	0.093
Plan, ft.	6x140	3x26	0.093
Length of tubes, ft.	720	288	0.4
Acid flow, g.p.m.	56	300	5.35
Over-all ΔT , deg. F.	22	24	1.1
Heat transferred, M B.t.u. per hr.	314	2,270.0	7.24
Heat transfer, B.t.u. per hr., sq.ft., deg. F.	26.3	270.0	10.7

* The curve in Fig. 5 gives useful information on the overall coefficients of heat transfer (Btu/hr.-sq.ft. av. deg. F.) obtainable with 20 deg. B6. muriatic acid at 90-110 deg. F. through 4 in. I.D. by 5½ in. O.D. Karbate tube with water flow (78-100 deg. F. temperature range) on exterior, of 7 gpm.-ft. length of tube).

with the older units. One of the Karbate heat exchange units (front view, Fig. 4) was equipped with a removable plug on each row to permit inspection of pipe interiors which, of course, is one of the advantages of visibility provided by glass. After lengthy service, there was no measurable decrease or increase in the wall thickness, so new units now have a plug in only the top pipe.

Fig. 3 illustrates one of the original small 3 in. I.D. Karbate coolers, 12-ft. long, 16 rows high, in front of one of the double-deck glass-tube trough coolers. Only some 10 percent of the length of the glass-tube cooler is shown in this picture. The smaller unit, on the basis of surface areas of tubes and overall coefficient of

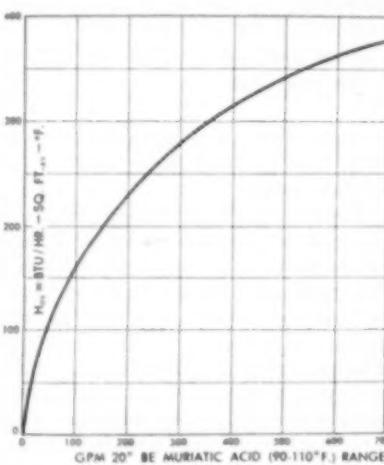


Fig. 5—Over-all-heat-exchange coefficient through 4 in. I.D. by 5½ in. O.D. Karbate tube, 7 gpm water per ft. length on exterior. H_o range — 78 to 100 deg. F. HCl range — 90 to 110 deg. F.

heat transfer, removes as much heat from the acid at this plant as the double-deck glass-tube cooler partially shown in the background. It has had a flow through it of 200 gpm. of acid continuously since 1941, without requiring any maintenance. In fact, these units have performed so satisfactorily that four additional units have been installed and another one is on order to provide for further enlargement of plant capacity and the production of stronger acid.

ELECTROCHEMICAL INDUSTRIES (Continued from page 106)

ployed here. These industries usually require fewer operators per unit of output than comparable non-electrolytic establishments, but these operators must be somewhat more skilled.

Power costs—Electrochemical industries naturally consume relatively large quantities of power and the cost of power cannot be ignored. It is, however, not necessary to

have hydroelectric power. This may have been true in the past, but this condition is changing. In a paper presented at the Buffalo meeting of the Electrochemical Society, by MacMullin and Gardiner, it was mentioned that of the 1,770,000 kw. now being used by industry at Niagara Falls, 545,000 kw. or nearly 31 percent is being supplied from steam generating plants.

With the trend toward higher steam pressures and higher superheats and with the improvements that have been made and are being made in turbine generating equipment, the cost of steam power is tending to decrease. This plus the fact that steam plants are not confined by geography but may be placed where markets demand, gives steam power certain advantages which should not be overlooked in establishing an electrochemical industry.

Caustic soda is an example. This requires roughly 2,600 kwh. per ton. Let us assume that there is a difference of 2 mills per kwh. between power cost, say at Niagara Falls and in the Midwest. This is equivalent to \$5.20 per ton of caustic. However, much of the caustic is shipped as a 50 percent water solution in tank cars so the net difference in cost due to power is only \$2.60 per ton of liquid shipped at 13c. per 100 lb.

Gross and net revenues—The gross revenue of the electrochemical industries is affected by the same economic factors that affect price and volume relationship in most other basic industries. Since practically all electrochemical products are used in making or processing other goods, they are in the category of manufactured goods rather than consumer goods and are therefore largely dependent upon other industries to provide the market.

Competitive factors, however, are always present so that price and volume relationships and therefore gross revenues are not entirely within the individual manufacturer's control. The cost of selling goods and the cost of transporting them to market do affect the net revenue and these factors are subject to good management and plant location. No matter how good the management may be, it cannot completely offset a poor plant location. Proper plant location will save many dollars in freight cost to markets and will help to increase profits by narrowing the spread between gross and net revenues.

From Figs. 3 and 4 it is apparent that the profit area can be increased by increasing volume of business or it may be completely wiped out if volume of business descends below the crossover point. In setting up an enterprise of this sort, therefore, the scale of operation and the plant capacity must be carefully determined in advance in order to avoid setting up too small an operation to function properly or setting up such a large operation that it cannot, for lack of markets operate close to capacity at all times.

Predicting Viscosity of Gases at HIGH PRESSURE

Where reliable data on the viscosity of gases at high pressures are not available, a sufficient degree of accuracy can usually be obtained for design purposes through the use of a new chart developed by the authors. To employ the chart in predicting the viscosity at some elevated pressure it is necessary only to know the critical pressure and temperature of the gas, plus the viscosity at atmospheric pressure.—*Editors*

VARIOUS gases are continually being handled in industrial equipment under high pressures. The design of equipment for such use requires data on the physical

properties of these gases under the pressures used. This article describes a method for predicting the viscosity of a gas under pressure, using only the critical temperature, the critical pressure, and the viscosity at atmospheric pressure of the gas. The method is presented first and the evidence on which it is based is briefly described later.

In the accompanying chart the solid curves give a general relationship between the viscosity ratio and the reduced temperature and reduced pressure of a gas. The "viscosity ratio" is defined as the ratio of the gas viscosity at any elevated pressure to its viscosity at atmospheric pressure, when the temperature at both pressures is the same. The "reduced pressure" is the ratio of the elevated pressure to the critical pressure of the gas, and the "reduced temperature" is the ratio of the temperature of use to the critical temperature of the gas.

The chart has been revised and corrected from a correlation published in 1940.¹ At that time data were not available for a considerable range of reduced

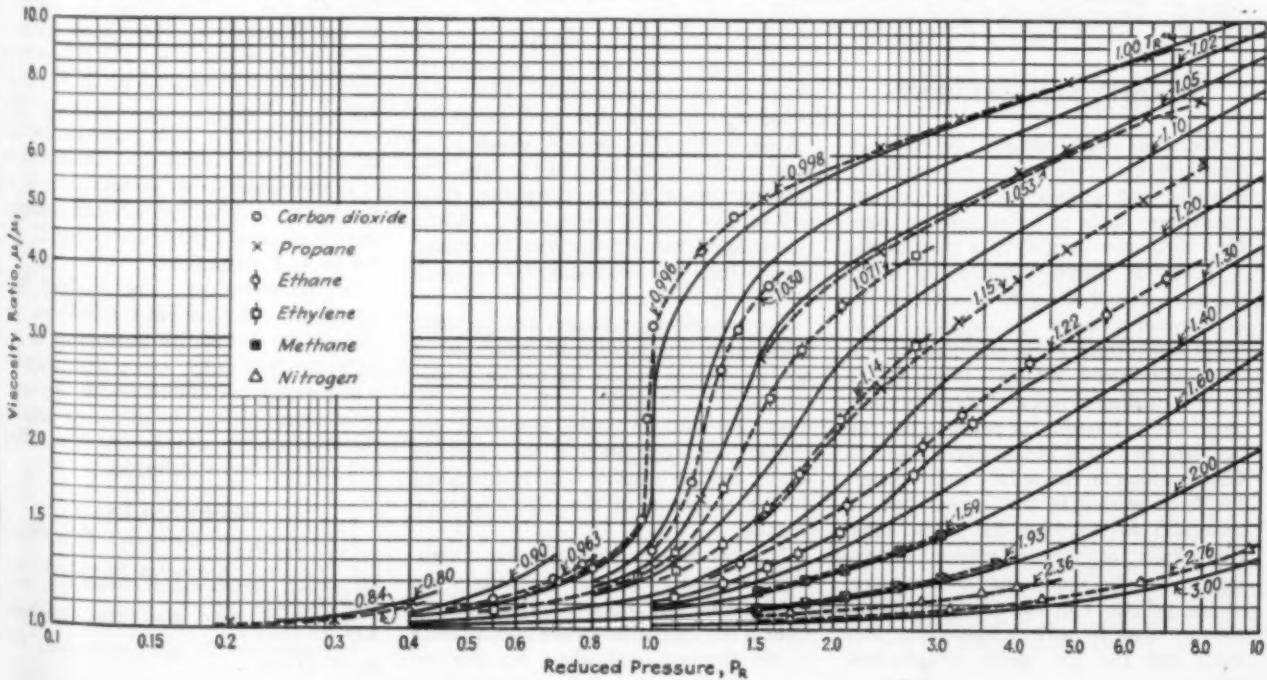
temperature and lack of agreement between the data by different observers caused considerable uncertainty. Data in the missing range have now been obtained and a careful selection made from the work of other observers.

To make use of the chart some value of the viscosity of the gas at atmospheric pressure must be known. This can be corrected to the desired temperature using the Sutherland formula or a simple exponential relation.² The increase in this viscosity resulting from the increased pressure on the gas is obtained by reading the viscosity ratio from the chart at the desired values of reduced temperature and reduced pressure. The viscosity at atmospheric pressure then is multiplied by this ratio.

BASIS OF CORRELATION

The kinetic theory of gases indicates that a similarity should exist between the viscosity ratio μ/μ_1 , the thermal conductivity ratio k/k_1 , and the molecular dif-

Chart giving general relation between viscosity ratio and reduced pressure and temperature of a gas; dotted lines are plots of some representative data, while solid lines are averages of all suitable data available



fusivity ratio D/D_1 , where the two latter ratios are defined as the ratio of k or D at an elevated pressure, to that at atmospheric pressure. It was also expected that these ratios would be the same for all gases when compared at the same value of reduced temperature and reduced pressure for each gas. It is possible to show analytically and by dimensional analysis that if the gas viscosity can be expressed as a function of pressure and temperature using only two constants, other than the molecular weight, depending on the nature of the gas as follows:

$$\mu = f(T, p, a, b), \quad (1)$$

then there must also be a relation

$$\frac{\mu}{\mu_1} = f_1\left(\frac{T}{T_e}, \frac{p}{p_e}\right) \quad (2)$$

which is independent of the nature of the gas. Equation (2) is the relation upon which the correlation in the chart is based. Since Equation (1) is not necessarily true the validity of Equation (2) rests on agreement with experimental data.

The observations of others on the viscosity of gases at high pressures were carefully reviewed and a selection made of those which were neither obviously in error nor questionable. This was necessary since separate observers have reported gas viscosities that differ widely and make a correlation of all their results impossible. The experimental methods used and the theory behind the calibration of the instruments provided a basis for judging the data. Only those data obtained under laminar flow conditions which extrapolated smoothly from elevated pressures to the atmospheric pressure value were used. Some results limited to pressures well below the critical were omitted. When two sets of measurements were available the more extensive and the more consistent set was selected. This eliminated a good proportion of the data available in the literature.

VISCOSITY MEASUREMENTS

Additional high pressure gas viscosity measurements were made on methane, ethylene, and propane. These measurements were made in a glass capillary Rannine viscometer housed in a steel bomb. A pellet of mercury descending under gravity in a large bore glass tube forced the gas upward through the capillary. The bomb was pivoted at the midpoint to permit end-over-end rotation through 180 deg. This allowed repeated check measurements of the time for the pellet to descend between two sets of tungsten contacts. Gravity acting on the pellet fixed accurately the force applied to the flowing gas. A correction was necessary due to the different effects of surface tension of the mercury at the upper and lower surfaces of the pellet. This correction was found to vary slightly with temperature, pressure, and the gas under investigation.

Sufficient measurements were made to establish this correction for each gas. The capillary itself was carefully examined along its length and an integrated fourth-power average radius was determined, accurate to within the order of a micron.

This viscometer gave a direct determination and did not depend on calibration with gases of known viscosity. Nevertheless, measurements were made on carbon dioxide for comparison with the data of Phillips² and Stakelbeck.³ These agreed with the above within 10 percent or as well as Phillips and Stakelbeck agreed with each other. Two nearly identical instruments were constructed and both were used to determine the 40 deg. C. viscosity-pressure isotherm for ethylene. The agreement here was excellent. It is estimated that the uncertainty of the viscosity measurements from this investigation is not more than 1 or 2 percent.

MAKING THE CORRELATION

The data selected from the literature together with these new measurements formed the basis of the corrected correlation. This comprised viscosities of carbon dioxide, nitrogen, methane, ethylene, ethane, and propane. The data for each gas were plotted as viscosity ratio against reduced pressure at constant reduced temperature. A cross plot was prepared by plotting viscosity ratios for the different gases against reduced temperature for a number of values of reduced pressure. The average curves were drawn through the points. The values read from these average curves were used to construct the general correlation of viscosity ratio versus reduced pressure at constant values of reduced temperature.

Some of the data used are shown plotted with the correlation curves in the chart. It is seen that the fit is very good over the whole range of reduced pressures and reduced temperatures covered. The correlation represents the data used, except for ethane, within a few percent, which is the accuracy claimed for most of the data. The data for ethane fit the correlation fairly well up to a reduced pressure of 2. Above this reduced pressure the data for ethane deviate from the correlation by as much as 10 to 12 percent.

For reduced temperatures and pressures below unity the method of correlation is not so accurate unless limited to similar compounds such as the paraffin series. The reason for this, no doubt, is that at low temperatures aggregation of the molecules occurs, and the behavior is more dependent on the properties of the individual compounds.

It is not recommended that the correlation be used to obtain viscosities when reliable data are available. However, the chart is very convenient when high accuracy is not required, and where no data are

available. When a set of data disagrees markedly with the correlation it is suggested that more reliance be placed on the correlation than on the data unless the latter have been verified by independent investigators.

EARLIER PREDICTIONS

A comparison of the corrected correlation with that published in 1940 shows in general a somewhat smaller effect of pressure. Below a reduced pressure of unity, the effect of pressure is still somewhat uncertain but the new curves show it to be considerably less. Above $P_r = 1.0$ the range from $T_r = 1.05$ to $T_r = 1.50$ has been made more accurate. Data were not previously available in this range. Thus at a P_r of 2 a 42 percent increase in viscosity over that at atmospheric pressure is shown at a T_r of 1.30, compared to a 75 percent increase as predicted by the earlier chart. At higher and lower values of T_r , where data were available for the earlier correlation, the changes are not so marked. The chart has been extended to reduced pressures of 10. Three lines for T_r of 2.0, 2.50 and 2.80 are extended to $P_r = 30$ on the earlier chart. These are essentially unchanged but are not shown beyond $P_r = 10$ on the new chart.

Almost no data on the effect of pressure on the thermal conductivity and molecular diffusivity of gases are available. Until such information is available it is suggested that the chart be used as a rough prediction of the effect of pressure on these factors. To do this the ordinate is read as a thermal conductivity ratio k/k_1 or a diffusivity ratio D/D_1 , as the case may be.

A detailed account of the experimental work and the preparation of the correlation are given in the recent University of Illinois Engineering Experiment Station Bulletin Series No. 354, "The Viscosity of Gases at High Pressures," by E. W. Comings, B. J. Mayland, and R. S. Egly. The new gas viscosity data reported are for ethylene at 30 to 95 deg. C. and 5.08 to 171 atmospheres, for methane at 30 to 95 deg. C. and 4.40 to 171 atmospheres, and for propane at 30 to 104.5 deg. C. and 4.4 to 41.8 atmospheres.

A discussion of the rolling ball viscometer is included in the Bulletin. Although the use of this instrument in the turbulent flow range is not recommended a new method of calibration for this range is described. It appears to explain some of the discrepancies between data from rolling ball and capillary viscometers.

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CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

\$50 WAR BOND FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award a \$50 Series E War Bond each month to the author of the best short article received during the preceding month and accepted for publication in the "Chem. & Met. Plant Notebook." Articles will be judged during the month following receipt, and the award announced in the issue of that month. The judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest may be published if acceptable, and if published will be paid for at space rates applying to this department.

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as

many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

January Contest Prize Winner

NOVEL NOMOGRAPHIC CHART SOLVES VAPOR—LIQUID EQUILIBRIUM FOR BINARY SYSTEMS

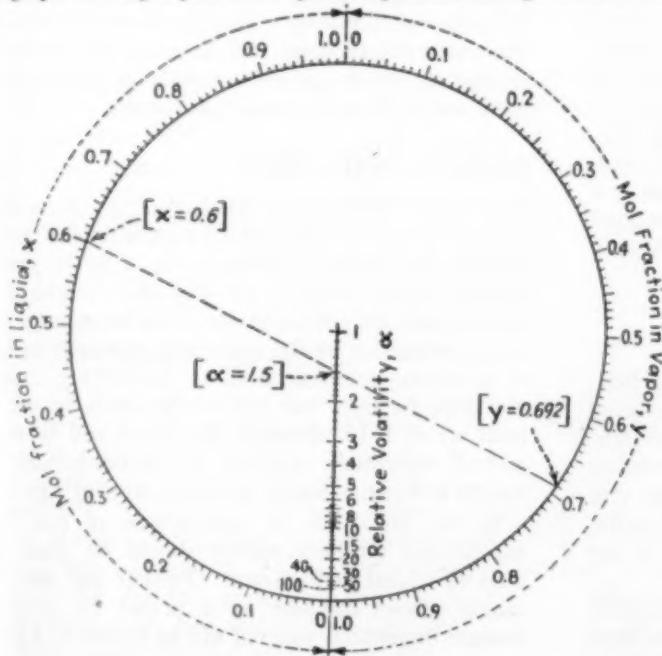
C. R. FRANKLIN

Derby, England

THE RELATIONSHIP between x , the mol fraction of more volatile component in the liquid phase, y , the corresponding vapor composition and α , the relative volatility, is expressed by the formula:

$$y = \frac{\alpha x}{1 + (\alpha - 1)x}$$

Nomograph relating liquid and vapor composition through relative volatility



The accompanying nomograph is based on this formula. The circular scales representing the composition of the liquid and vapor in terms of mol fraction of more volatile component, are arithmetic. The relative volatility scale has been marked out empirically from values that were obtained

FEBRUARY WINNER!

A \$50 Series E War Bond will be issued in the name of

DONALD F. OTHMER

Polytechnic Institute of Brooklyn
Brooklyn, N. Y.

For an article dealing with the use of a pressure gage and orifice in equipment heating which has been adjudged the winner of our February contest.

This article will appear in our April issue. Watch for it!

by calculation from the formula given above.

For example, in the case shown on the nomograph, where $x = 0.6$ and $\alpha = 1.5$, $y = 0.6 \times 1.5 / (1 + 0.5 \times 0.6) = 0.692$. The same result is given by the chart.

It is of interest to note that the nomograph is equally applicable to the conversion of weight fractions into mol fractions. In this case:

$$x_1 = \frac{(m_2/m_1) w_1}{1 + (m_2/m_1 - 1) w_1}$$

where x_1 = mol fraction of lighter component; w_1 = weight fraction of lighter component; m_1 = molecular weight of lighter component, and, m_2 = molecular weight of heavier component. The terms x_1 , w_1 and m_2/m_1 may thus be substituted for y , x and α respectively in the chart.

CALCULATING STEAM FLOW THROUGH ORIFICES

THOMAS N. DALTON
Thermal Design Engineer
Heat Transfer Products, Inc.
New York, N. Y.

IT is often necessary to measure or limit steam flow through the use of an orifice. A much simpler method of determining the orifice diameter, or conversely, of determining the steam flow, than the usual procedure of using Mollier diagrams and continuity equations is to employ the accompanying charts together with the equation:

$$AB \sqrt{w} = d$$

where A is a function depending on the initial steam conditions (which for saturated steam is given in Fig. 1); B is a function depending on the ratio of final to initial pressure, given in Fig. 2; w is the steam flow through the orifice in pounds per hr.; and d is the orifice diameter in

(Continued on page 120)

FROM THE VIEWPOINT OF THE EDITORS—

S. D. KIRKPATRICK, Editor • JAMES A. LEE, Managing Editor • THEODORE R. OLIVE, Associate Editor • HENRY M. BATTERS, Market Editor
J. R. CALLAHAM, Associate Editor • L. B. POPE, E. C. FETTER, R. W. PORTER, Assistant Editors • R. S. McBRIDE, Consulting Editor

FACULTIES FOR THE POSTWAR

THE MOST urgent need of the chemical engineering profession is for a continual flow of well-trained young men out of the colleges and into the process industries, year after year. The policy followed by Selective Service during the early years of the war seriously interrupted chemical engineering education, and it will be a number of years before we have a normal flow of professional graduates. There is nothing we can do about that.

The future prospect is, however, largely within the control of the present profession. When we may stop sending young men to war and let them go to college there will be a sufficient flow of competent worthwhile candidates for the bachelor's degree in chemical engineering. The universities and colleges are fairly well equipped physically to receive and train them. But the faculties in the departments of chemical engineering are sadly depleted through the scattering which was unavoidable as those men took on a variety of war tasks. The profession must now see to it that the rebuilding of these faculties takes place promptly and effectively.

This generalization is easy to state, but very hard to reduce to specific actions which individuals can and should take. But the profession as a whole must consciously seek an opportunity to support the universities and to encourage competent educators to return to their teaching tasks. In many cases this influence can take the form of fellowships, assistantships or even consulting retainers. All these things must be done in such a way that the educator may devote himself primarily to his teaching which, after all, is his most important contribution. And in these tasks he must have time and opportunity for professional research aided by the fellows or research assistants that industry can give. The types of retainers given to the professor must be such that they will stimulate his professional effort and not divert him from his scholastic responsibilities. Altogether this is a difficult matter. But the net result can easily be so good or so calamitous that it is worth serious thought and constructive effort by every chemical executive.

HARD AND/OR SOFT

WPB's Chemicals Bureau has lately been suffering from two opposite criticisms. It has been charged with being lax in control of certain allocations. It has been charged with being dilatory in approval of certain construction projects. This friendly criticism, and it has been very friendly, has perhaps been based on the failure to realize that being tough and being soft simultaneously is not beyond the realms of possibility.

The "softness" charges seem to have been actually present in a few cases where military authorities have been

allowed to buy excessive quantities of certain chemicals with resulting unnecessary restriction on other customers who serve only indirect military or essential civilian needs. There are a few cases where such relaxing of controls on the military seems to have created elsewhere an unnecessary hardship.

But the "dilatory" charges have apparently not come from faults of the Chemicals Bureau at all. The delays criticized have been almost wholly traceable to the Facilities Committee restrictions on approvals for new construction or expansion of facilities in areas of labor shortage. The Committee has apparently been exercising its authority blindly under the order of Justice Byrnes to prevent all new construction in such areas. Perhaps the Deputy President made his order a bit more sweeping than he realized. Certainly some of the construction still needed must be done where the skills to use the construction exist, even if these be labor-scarcity areas.

A PROPER SPECIFICATION

CHEMICAL engineers working with officials of the Interstate Commerce Commission have recently disclosed an interesting case of ineffective specifications. Certain gas cylinders were defined with great detail as to methods of manufacture. It was found that those methods could much better be left to the direction of the manufacturer and the specification formulated on the basis of the performance of the finished cylinder.

Perhaps there are other container specifications that could well be reviewed from this point of view. It is a long established principle that a good specification defines the end result expected and leaves to the manufacturer an opportunity to use his ingenuity in getting that end result most effectively and economically.

RUBBER ECONOMICS

ONE of the interesting proposals that have been made for postwar control of the rubber situation in this country is that the government should set up a quota system for natural rubber imports whereby the volume of such imports into the United States would be reduced in some direct proportion to the reductions obtained in the cost of producing synthetic rubber. Something comparable was done for dyes and coal-tar chemicals in the special tariff act of 1916, although the record will show that it proved exceedingly difficult of administration. Even greater difficulties would probably arise in this case.

In the first place all comparisons of cost between natural and synthetic rubber should be made on the basis of related performance. To date the new product cannot always compete on a pound for pound basis because the natural material will go farther in a particular

operation and will nearly always cost less for processing. On the other hand there are specialty uses where the synthetic is definitely superior and worth many times the cost of natural rubber.

A second complication is the desirability for maintaining in this country—regardless of cost—a synthetic rubber industry of sufficient size to serve as a nucleus for full-scale development in case of another emergency. Careful students of the problem believe that a minimum of 200,000 long tons of capacity should be kept in operation here as a sort of national insurance policy against the violent fluctuations of the prewar rubber market.

Few realize that in normal times the people of the United States saved \$17,000,000 a year for every one-cent reduction that occurred in the cost of imported rubber. On the basis of some of the prewar fluctuations, it might be possible for our synthetic-rubber plants to force a reduction of as much as 20 cents a pound in the cost of imported rubber. On such a basis the American synthetic-rubber plants could more than pay back the cost of the entire program in only two years! With so much at stake, we must go slow in curtailing research that will lead to better quality and lower costs for American rubber.

NO NATURAL FOODS LEFT?

MAKERS of vitamins and chemicals for enrichment of foods are now confronted with a new problem in public relations. Serious question is being raised in official and medical circles whether there has not been too much commercializing of these commodities. One important Food and Drug Administration executive said, "It is getting so that soon there will be no natural foods left."

This official and his associates are not at all opposed to food fortification with proper nutrient components. They have supported sound programs. They recognize them officially in standards of identity for foods. They will continue to do so.

But these officials are much disturbed by the ballyhoo. They believe that it is time to look at each new proposal very carefully to be sure that it is really in the public interest. They have taken such a stand during January and February hearings when it was proposed to establish a new standard of identity for enriched macaroni.

Chemical producers interested are going to be harmed badly by their over zealous customers if something is not done about it. Perhaps some of the advertising of the primary chemical producers is itself at fault. Certainly it appears to be time to take account of the caution expressed in Washington on these subjects.

OUR CONSTITUTIONAL RIGHT?

WHEN John L. Lewis was asked whether or not he intended to cancel the national wage conference of the United Mine Workers of America he is reported to have countered with three questions of his own: "No meeting? No contract? No coal?" Needless to say, the coal conference is among the 15 scheduled conventions and meetings which won the approval of the Office of Defense Transportation. Of the 469 applications that had been denied up to February 15 there was an increasing number of requests from technical and educational societies. As

far as we are aware, the only engineering society to have obtained official approval is the Society of Automotive Engineering's subdivision on aeronautics which was permitted to hold its Materials and Processing Symposium in New Orleans. So stood the box score on February 15: approved 15; rejected 469.

Article I of the first amendment of the Federal Constitution declares that "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the government for a redress of grievances." Most of us, of course, have no very serious grievance against the government for having taken away our rights for peaceable assembly in the annual and semi-annual meetings of our technical societies. In recent years some had grown to such proportions that they did disrupt railway traffic and interfere with more important war business. But, as time goes on and the War Committee on Conventions gathers more knowledge and experience, we hope that it will find greater opportunity to use critical judgment in deciding what meetings can contribute most to the war effort. Coal is important, and so is labor. Agriculture is important, and so is food processing—although to date all of the latter meetings have been denied. Management, when meeting on war problems, should have the same rights of assembly that are accorded to labor. Chemists and chemical engineers, as well as automotive engineers, have the same need to exchange first-hand views and ideas on their war problems.

"CANCER CAN BE CURED"

TAKE this on the authority and personal experience of a well-known chemical engineer. His own case and others that have come under his observation convinces him that "when the cancerous growth is young, cure, not relief, is the expectation."

As an equipment engineer, this man had been doing development work on an incinerator in an eastern chemical plant. He had been working with partly decomposed organic solvents and other irritants that attacked his throat during too long or frequent exposures. Let him tell his own story from here:

"In time, I began to be hoarse. In July, the doctor treated me for laryngitis. In early August I had to take a vacation and rest. After ten days of loafing, I completely lost my voice. I beat it back to our throat specialist who found 'no infection' but in looking down into the larynx discovered a small ulcer on the vocal cords. Later an associate made an inspection and said he hoped 'the growth was benign.' Within 24 hours I was being 'inspected' at the Hospital, and on September 24, 1944 they operated. Today, I am feeling fine, having regained weight and except for some diminution of vocal power, I am in better health than in 20 years."

Our friend writes to urge that all of us should do our part in spreading the knowledge that will help cut down the needless waste of one out of six dying of cancer. Early treatment is the answer! Eric Johnson and other prominent Americans are strongly backing the April drive for funds for the Cancer Society. They will welcome your support.

inches. If the steam is not saturated, then A should be calculated from the expression $A = (v/p)^{1/4}$, where v is the specific volume, cu.ft. per lb.; and p is the upstream pressure, lb. per sq.in. abs. Fig. 2 is used for B for all steam conditions. Below the critical ratio, 0.548, the value of B is constant at 0.0433. Above the critical ratio the value is as given in the equation on the chart where k is the ratio of specific heat at constant pressure to that at constant volume (1.30 for steam); p_1 and p_2 are the initial and final absolute pressures; and 0.60 is the orifice coefficient.

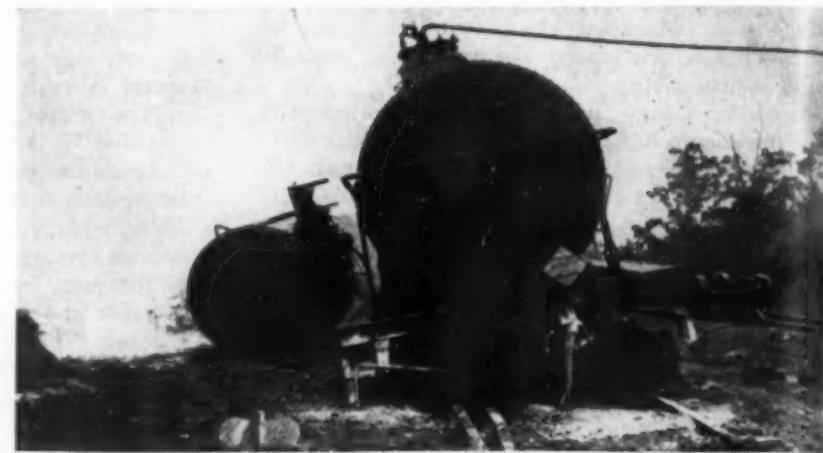
For accurate use the reader will wish to construct his own charts of Figs. 1 and 2, so that coordinates for plotting are given on the charts. Fig. 1 is plotted on a log-log grid and Fig. 2 on a rectangular grid.

As an example of the use of the charts, find the size of orifice which will pass 150 lb. per hr. of dry saturated steam at 50 lb. per sq.in. abs., with a 5-lb. pressure drop. From Fig. 1, $A = 0.643$. The ratio of initial to final pressure is $(50 - 5)/50 = 0.90$, so from Fig. 2, $B = 0.0546$. Hence, the orifice diameter, d , is $0.643 \times 0.0546 \times (150)^{1/2} = 0.429$ in.

HOW NOT TO HANDLE TANK CARS

A VALUABLE object lesson in the handling of tank cars at the unloading dock was presented in a recent issue of *The Volunteer*, employee newspaper of the Volunteer Ordnance Works, operated by Hercules Powder Co. at Chattanooga, Tenn. The accompanying views show what should have been done, what was actually done, and what happened as a result of the failure to observe an elementary precaution.

One of the acid unloading docks at this plant is located on a slight grade, making it necessary always to chock cars at the dock, thus avoiding any possibility of their breaking loose and coasting. For this purpose it is a standing rule to chock one wheel with a metal chock secured to the track, while the remaining wheels are



An acid tank car, left unchoked at the unloading dock, broke away and pushed a second car ahead of it to the finale shown in the upper view; below, at the left, the car is properly chocked, while the view at the right is a reenactment of the bit of carelessness which led to the accident

blocked with wooden chocks. This is in addition to setting both the air brakes and the hand brakes. In a recent instance, however, this was not done. The car broke loose and destroyed the dock, then, pushing another car ahead of it, careered down the track until both cars were derailed and the acid car over-turned. Several yards of rail were torn up and the contents of the acid car was lost.

The topmost view shows what happened when the cars broke loose, the acid car (behind) spilling its contents on the ground. Below are closeups of the car at the dock. At the left the metal chock is properly in place as shown by the arrow. The right hand view is a reenactment of what preceded the accident, with the chock that wasn't used carelessly left between the tracks.

Fig. 1—Values of factor A for various initial absolute pressures of the steam

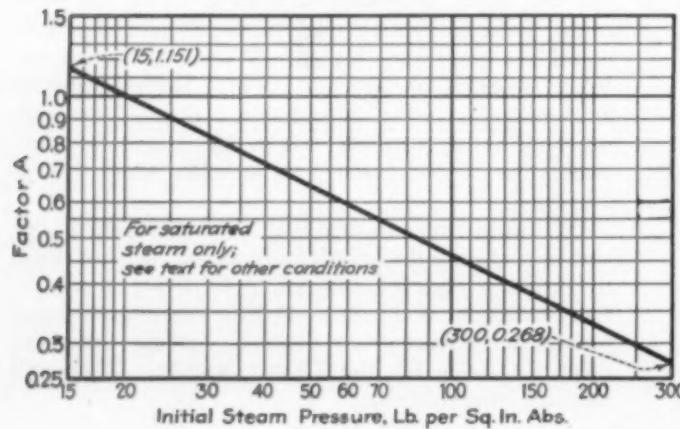
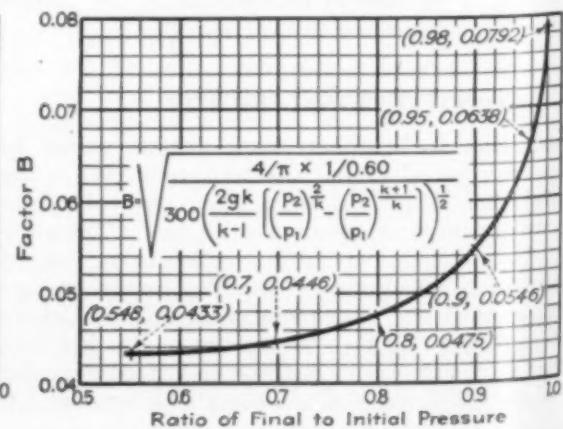


Fig. 2—Values of factor B for various ratios of final to initial absolute pressure





REPORT ON.....

TECHNICAL SERVICE

Value to Chemical Process Industries

Technical service is no longer solely a fire department to put out the fires of customer complaints. The work of the department has been broadened to include all aspects of the utilization of chemicals and other products of the process industries. As the chemical industry becomes more mature in this country, there is a greater need for this type of service. Years ago products were limited to a few, well-known heavy chemicals and there was little or no demand for such service, but the ever increasing complexity of such products as synthetic resins, synthetic rubber compounds, plasticizers, solvents, and catalysts has naturally called for technical service, made it obligatory for the producer to assist the consumer in the proper utilization of the materials. And after the war as we pass from a sellers' to a buyers' market, competition will return and with it the necessity to assist the consumer in every possible manner.

IN AN endeavor to advance the utilization of chemicals in industry there has developed a trend toward the integration of activities such as technical service, sales analysis, market research, market development, and application research, which are in general liaison functions between research, production, sales and management. The organization details are in a state of flux, but there are indications that in some of the larger companies responsibility for these activities is gradually being centralized in the hands of a development director who assumes a position parallel to those of research, sales and production directors. While some semblance of uniformity in these organizations prevails throughout the industry, it is highly unlikely that there will ever be a uniform type of technical service organization. Opposed to uniformity are such factors as difference in size of companies, number and nature of products, and fields of sale activities.

It seems opportune to review the present status of technical service in view of the state of flux in which this branch of service is today and its increasing importance in a chemical company organization. The functions; relationship to sales, production and management; and the desirable qualifications of the personnel will be considered. For the most part the thoughts expressed here are those of the leaders in the field.

FUNCTION OF THE SERVICE

Function of technical service, as the term is most generally used at present, is to act as a technical advisor to customers and to production, research and sales departments of the producing company on all products that have been adopted or are being considered for adoption as sales items. This includes coping with field complaints and problems encountered in

the use of established products, extending the field for these products, i.e., new customers and new uses and introducing new products. Field trials, demonstrations of the value of a product, evaluation of results and consumer acceptance are all within the province of the department. In some companies technical service directs the application research required for successfully extending the field for the established products and introducing new products. It also comprises the maintenance of specifications on finished products, and supervision of technical features of publicity and advertising. Technical service is a part of an orderly procedure to accomplish the sale of a product. The conveying to the interested party of a knowledge of the characteristics and quality of the commodity is the basic element of the service.

In other words, technical service can be the connection link between producer and consumer whereby both are kept informed

of changing conditions. By means of it there can exist a community of interest through which both can benefit. The worth of the results obtained depends largely on the degree of cooperation established and the degree of confidence the customer is willing to repose in the manufacturer's technical staff.

Often it works out that the customer may have two or three competing manufacturers working independently on the same problem. This cannot be considered unfair and the manufacturer must take his chances for participation in the resulting business.

Unless a producer can be in on the ground floor with his client and can work out with him the best and most efficient combination of material and technology, he will probably participate only meagerly in subsequent expansion. The consumer, once his product is established, is reluctant to make changes that, unless they greatly cheapen costs, may influence adversely the purchaser acceptance of his commodity. This may be because of change in workability, appearance, feel, odor, or any one of a wide variety of psychological factors that may produce an adverse trade reaction. Conversely a manufacturer who wishes to introduce a new material or product has a correspondingly difficult job of customer research on his hands.

There are occasions when technical service is called upon to design or assist in the design of equipment. An example may be cited of the case of a chemical manufacturer who had interested a pulp and paper mill in using his bleaching agent. This was a chemical with which the mill men had no previous experience. Several pieces of special equipment had to be designed in order to handle the bleach. This was done by the chemical company and the plans made available to the pulp and paper mill.

WHAT MANNER OF MAN

This service must be in the hands of competent personnel. Only a few of the characteristics of the ideal type of man can be mentioned. He should have a broad knowledge and experience in order that he may be logical and impartial and neither unduly optimistic nor pessimistic. Youth with its optimism and lack of experience, should generally be avoided here. Any organization can well afford to place an older, more experienced, perhaps more expensive, man in this type of work. Honesty, the reputation of being a "square-shooter," and tact are possibly a technical service man's greatest assets; without honesty, failure is inevitable; without tact, the required contacts with others become useless.

His proper training and development in scientific and technical matters are vital but it is necessary that he be trained in

organization consciousness. The necessity of conferring and dealing with other individuals demands a man developed not only from the technical side but from the personal side as well. He must have an appreciation of economics and of the ultimate goal: profit to his organization. Hence, his training and development and his proper location are essential to his organization's welfare, most fruitfully to be accomplished only under a carefully considered continuous and consistent directional program.

The producer's representative should so conduct himself as to inspire confidence, but above everything else he should not assume the attitude of "knowing it all." Such an attitude engenders antagonisms, which not infrequently become deep-seated and permanent with consequent loss of the producer's time and money and his chance of helping the salesman to make a sale. It is surprising how often a simple suggestion is cordially received.

It is well to feel one's way along particularly if there is a lack of familiarity with the organization. There are often practical questions as to rank and other organization matters against which the technical service man may run afoul. The situation in any case can be handled diplomatically. It is, of course, essential for the technical service man to see to it that he is welcome to return. Succeeding visits are the ones that often prove the most profitable.

AMBASSADOR OF GOOD WILL

Nowhere is faulty man location more immediately apparent than in this department. Customers and sales accounts are frequently lost, either temporarily or permanently, through faults or failings of the service man. This man is the ambassador of good will—or ill will—depending upon his knowledge, ability and general deportment. His outside contacts are more frequent than those of his company co-workers and his ability to retain old friends and to make new ones are among his gravest responsibilities. A good basic training in chemistry or chemical engineering is required. With his technical skill there should be combined a large volume of common sense. Vision and imagination he must have, but they are of small value unless he also has the ability to evaluate practicabilities. He must have a sense of economics. If he has no actual sales experience, he must at least have sales sense in order that his work may be synchronized with the sales department.

It appears axiomatic that the successful technical service representative should be thoroughly schooled in the technology of his own industry and in particular his own company's plant in order that he may have a practical viewpoint with respect to the solution of problems which may arise

in the customer's plant. This familiarity can be had by tackling first hand its many problems. This implies serving a certain length of time in his company's control, research, application and other laboratories,

The technical service man who does the best job for his company, both from his company's standpoint, and from that of the customer, will know the production operations and facilities of his company. This can best be gained by serving for a time in the plant and while there obtaining first hand knowledge of as much of the operations as possible. It would be an advantage to know, for example, if necessary, are higher efficiency distillation facilities available? If so, about how much more will a purer product cost? Or, if savings can be effected through the use of another product, with what impurities will the customer have to deal? How much finer can a material be ground without seriously affecting the cost? Can steady production of the material be counted on or is the equipment used part time for other production? What are the by-product problems that his manufacturing department have on its hands?

SOURCE OF MATERIALS

One should be familiar with the source of the raw materials from which the product is made. It is necessary to have a thorough knowledge of the composition of the material, paying special attention to the impurities that are present and which may ultimately present a problem. It will often be found that knowledge about a seemingly unimportant detail of the product may be just what is needed to overcome competition of a product of equal quality but not as well presented. It is also worthwhile that a comparable knowledge of competitive basic raw materials be had.

Location of the producer's plant and the plants of the secondary supply source must be understood because many economic problems concerned with plant location have a direct influence on the quality of the raw material produced and on the service of supply to the manufacturers. A similar knowledge of the competitive situation is necessary.

Knowledge should be acquired of the accepted type of packages for shipment, of the method of storage, both at the point of production and at the nearby consumption points, and of the details concerned with handling and shipping to the manufacturer. Knowledge of the various types of uses for the material should be had and as much detail about the reasons for the uses as is possible.

The ideal situation is to keep the consumer so well advised of the properties and uniformity of the material that the problem of complaints, which may be brought about by misuse of the material, will not

occur. It is well to keep in mind that information about a product need not always be favorable to the product. It is advisable to inform the customer regarding the hazards involved in handling and in storage. If changes in properties are apt to take place during long storage they should be reported. Trouble may be avoided by discussing the adverse properties and the service man's integrity established in an advantage for future problems.

Technical service representatives have the responsibility of keeping the young members of the consumer's staff informed about the product and to see that changes in personnel do not disrupt the use of the product.

It may be necessary to work closely with the laboratory of the customer. The confidences that are exchanged under such conditions should be as carefully respected as those of the patient and physician relationship. In fact, the technical service man is in a position very much akin to that of a physician prescribing treatment designed to overcome or improve an unhealthy condition. This obligation will require the exercise of high moral judgment and the temptation will often come to let small bits of information get out of control if some immediate purpose seems to be served. But there is no middle ground in respect of confidence. Either you do or you don't. The value of a technical service man to his own organization is immediately and totally lost if he breaks a confidence in order to further additional sales.

PROBLEMS ENCOUNTERED

Typical of the type of problem turned over to a technical service department is that of the activated carbon manufacturer who requested the determination of some means whereby the supplier and consumer could get together so that the latter could buy what he needed and the former could furnish it.

In the case of activated carbon it is impossible to draw up performance specifications from which its action in a specific case can be accurately predicted. There is no correlation between such properties as carbon content, particle size, surface area, specific gravity, etc., and absorptive capacity, even for adsorbates of known composition and concentration such as benzoic acid. In commercial applications, neither the composition nor the concentration of color, odor, or other impurity, to be adsorbed are commonly known, so that predictability of performance from physical property specifications is impossible.

From the supplier's point of view, it is necessary to have a means of evaluating carbon, for controlling uniformity of production of various grades and to serve as a guide in the development of new carbons. Such an evaluation method must serve as a common denominator with regard to ad-

sorptive capacity of the carbons in general.

It was ascertained that the empirical Freundlich adsorption equation, which was originally applied only to the adsorption of gases was quite broadly applicable to adsorption from solution as well. The first piece of technical service literature, therefore, was a laboratory manual, which explained in detail to carbon users how to secure discolorization data, how to plot it, and how to interpret it, from tests conducted by their own laboratories on their own process liquids. The user was thereby enabled to determine for himself, quite accurately, which of a number of carbons offered was best suited for his needs, in regard to both efficiency and price. The information contained in the manual placed the sale and purchase of activated carbon on a rational basis, not only with respect to the original selection of a carbon, but also with respect to uniformity of quality in successive shipments.

In the dry cleaning industry, activated carbon is used continually to reclaim used solvents. Its function is the adsorption of color and odor picked up by the solvents from the clothing. The personnel of the industry is distinctly non-technical, so that conveying information on activated carbon to cleaning plant operators is a real challenge to technical service.

The technical service group also utilized the Freundlich equation to show that a given degree of purification could be reached with appreciably less carbon, if the carbon were used in two-step or three-step counter-current procedure. Laboratory tests verified the mathematical analysis, and a paper was published to place this information in the hands of carbon users. Parenthetically, it should be mentioned that instead of reducing sales volume of carbon, the counter-current procedure can be credited with sizable increases in volume, because it frequently made possible the use of carbon in applications where single-stage use would have involved prohibitive cost.

SERVICE AND RESEARCH

Common practice is to maintain extremely close relationship between technical service, and research and development, but under different directors. In a few companies the two groups are under the supervision of the same executive, and are geographically located under the same roof or in neighboring buildings. That such relationship is working successfully in these cases is probably due to leadership of unusual qualities.

A technical service director irrespective of whether his group is a part of the research or sales department can improve relations with research by fostering fraternizing of his men with the research men, and encouraging exchange of information. The geographical location of the two departments is important. It is a truism that

there is no substitute for frequent personal contacts. Also, proximity is of importance in promoting close and understanding relationships between the staff members of the two departments.

In their field work the technical service men gets ideas for research projects which should be turned over to the head of that department. All suggestions should be confirmed in writing. This method avoids a patent row over who is the inventor.

APPLICATION RESEARCH

It is not sufficient to make a product and announce its availability in order to secure orders. The product must be thoroughly tested by the company that makes it as to its usefulness within the industry for which it is intended, because the industry looks more and more to the producer, not only as to the product but also as to how to use it. Some chemical companies have extensive laboratory facilities for determining the utility of products or new uses for old products. These application laboratories are where chemical products are evaluated in terms of the customer's needs.

In some companies these special service or application research laboratories are under direction of the research executive, while in others they are supervised by development or technical service directors. Some of the laboratories deal with the problems of the principal fields into which the company's products are sold such as pulp and paper, leather, or rubber.

For example, a rayon manufacturer may have such a laboratory which serves (1) as a place for testing the yarn under textile mill conditions, and (2) as a training school for the technical service personnel. In cases where a customer wants advice on rayon applications it may serve as a free consultant service with actual demonstrations in this department whenever desired to prove a point. There may be machines of all types for the handling of rayon from raw stock to finished yarn or fabrics. As an idea of the amount of machinery it may be said to occupy over 100,000 sq.ft. of area. Almost without exception this machinery is commercial size in order to eliminate the many variables encountered using laboratory size equipment. The various productions are continuously processed on the customer's own type machinery in order to give the rayon producers' mills direct information on how the stock performs as the customers would use it. This may include tests on dyeing as well as fabrication as this type of test is difficult to obtain in the plant laboratory controls.

UNDER DIRECTION OF SALES

In most organizations the technical service group is responsible to the sales executive. However, it has been stated, "Dom-

nation of technical service by the sales department is bad both for technical service and research. If the situation is not carefully guarded, technical service becomes solely a fire department to put out the fire of customer complaints and to do customer development work, and research waits in vain for the evaluation of its products and effort." Notwithstanding the viewpoint of the executive who made this statement, in probably 95 percent of the chemical companies technical service is a part of the sales department which in the opinion of many executives appears to be the logical place in the organization for it.

The technical service man can play an important role in the sales department. He paves the way for the regular salesman and establishes his company with the client.

In the case of one company the sales staff and the technical service staff are identical, the same men perform both services. Success in this arrangement has been possible mostly because the company has only one product. These men specialize in groups of industries, and each covers the entire country.

Cooperation with the production division of the company is necessary so as to see that it makes the products for which there is a demand. It often develops that the service man obtains information which helps him to suggest to production changes in the processes, and methods of packaging to remove causes of complaints.

MARKET RESEARCH

There is a close tie-in between technical service and market research, they are both part of market development, the former covers the technical phases and the latter the economic, market survey, or fact finding phases.

Assuming that technical field men have recommended that their company engage in a research program directed at the ultimate production of a new chemical it is frequently desirable to have a field survey made. The market research personnel discuss the new product with potential consumers in order to determine the potential value of the chemical to consuming industries. These discussions usually clarify questions of product properties and consumers' specifications. They also may uncover worthwhile information about potential consumer requirements for the material.

On the basis of these potential requirements the company commits itself to a research and later to a semi-commercial scale production of the chemical. In many organizations the market development per-

sonnel is responsible for selling this small scale output, usually to selected industries. Once pilot plant sales are established there is developed from field work a more comprehensive picture of the overall market potential of the new product. At that time technical service and other market development personnel cooperate in preparing to turn the new production over for regular sales action.

CONTRIBUTION TO PUBLICITY

Technical service men may contribute technical judgment to what goes into advertising and publicity. Some of the most successful advertising copy of the chemical companies is not institutional or general. Most of it is made specific, based on fundamentals and application research. Such advertisements feature information and data concerning physical and chemical properties of the products and suggested applications placing increasing stress on how to use the advertised product. Millions are spent every year in the effort to tell consumers how to obtain greater value from products by using them properly, or by setting forth new uses for them. Thus are expanded markets created. This fits in with technical service and in effect con-

stitutes technical service because it imparts technical information to prospective users.

Publication copy, literature for use by salesmen at conventions or for direct mail, must be technically accurate and useful in the sense of contributing definitely to a sound appreciation of the product's utility. The advertising of technical products can hope to increase in effectiveness only as the technical service man more willingly, freely and frankly opens his mind to the man charged with the important function of sales promotion. Obviously, this cooperation must be based on understanding and it behooves the technical service man to seek a comprehension of all promotion functions.

IN CLOSING . . .

In closing it may be well to emphasize again that technical service no longer refers merely to the job of trouble shooting, in fact if the work is done well no complaints will develop. The activities of the service are spreading far beyond the original job to include all technical phases of market development. As a result it is establishing a position of considerable importance in the chemical company organization.

FUNCTIONS OF TECHNICAL SERVICE

1. To act as a technical advisor to customers and to production, research and sales departments of the producing company on all products that have been adopted or are being considered for adoption as sales items.
2. To cope with field complaints and problems encountered in use of established products, extending the field for these products.
3. To maintain specifications on finished products.
4. To make field trials, demonstrations of the value of a product, evaluations of results and consumer acceptance.
5. To serve as the connecting link between producer and consumer whereby both are kept informed of changing conditions.
6. On occasion, to design or assist in designing equipment for the customer.
7. To keep young members of the consumer's staff informed about the product and to see that changes in personnel do not disrupt use of the product.
8. To inform the customer regarding any hazards involved in handling and possible changes in properties which may occur during long storage.
9. To supervise technical features of publicity and advertising.
10. To convey to the interested parties knowledge of the characteristics and quality of a commodity is the basic element of the service.

Reprints of this report are available at 10 cents per copy. Address the Editorial Department, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

PROCESS EQUIPMENT NEWS

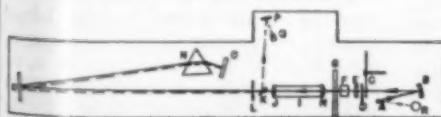
THEODORE R. OLIVE, Associate Editor

INFRARED SPECTROPHOTOMETER

FOLLOWING a large amount of experience with its infrared spectrophotometer which was described in our May 1943 issue, National Technical Laboratories, South Pasadena, Calif., has developed a new instrument of this type designated as model IR-2. The new instrument has been made as compact as possible, featuring maximum versatility, ruggedness, convenience and speed of operation, together with accuracy and stability. According to the manufacturers, it is being used to an increasing extent in plant analysis and control systems involving liquid and solid samples, as well as gases. Applied originally for routine analysis of hydrocarbon gases, the instrument has gained recognition as a means for general organic analysis.

Illumination is provided by a Nernst glower A, a beam from which is focused by a concave mirror B, after which the beam is interrupted ten times per second by shutter C, rendered parallel by a rock salt lens E and passed through the absorption cell F or I. A permanently mounted cell for gases is provided at I, together with a removable cell F for liquids. The beam, having traversed the sample, is focused on an entrance slit L, passing through to be reflected by a collimating mirror M through a rock salt prism N to a rotatable Littrow mirror O. The mirror reflects the beam back through the prism to the collimating mirror which focuses the beam on an exit slit below entrance slit L. Through this arrangement only radiation of a selected wavelength passes, through the exit slit from which it is directed by mirrors K and P on to a bolometer Q. The bolometer, capable of measuring the energy of the selected wavelength of radiation, is connected to an electronic amplifier which may then feed either to a recording meter or a recorder-controller.

Optical path of spectrophotometer



Cooling element of new crystallizer



The instrument may be set for any wavelength range from 0.546 to 15 microns, either by a calibrated continuous wavelength drive, or by a turret-stop mechanism with 17 adjustable turret pins of hardened steel. The wavelength control can be switched at will from continuous drive to turret stop and, if desired, a synchronous motor drive for automatic continuous wavelength scanning can be provided. Various features are provided to assure continued accuracy such as continuous automatic checking of the radiation source with phototube R and the use of continuous drying of the instrument interior by an indicating desiccant.

PNEUMATIC ASH SYSTEM

SEVERAL new design features have been incorporated in the Vac-Veyor pneumatic ash handling system produced by Beaumont Birch Co., 1505 Race St., Philadelphia 2, Pa. The ash receiver, separator and air washer are now combined in one unit and installed on top of the silo. The steam jet exhauster is located in the pipeline where it enters the receiver. The mixture of ash, steam and air enters the circular receiver tangentially at high velocity, centrifugal action throwing all of the heavy ash particles out of the steam and air before it has traveled more than half-way around the receiver. Ash falls directly into the silo while baffle plates in the separator, in conjunction with velocity reduction, are said to settle practically all of the light ash into the silo. The steam-air mixture then passes into the washer where any remaining light fly ash is removed by sprays and washed away through a 4-in. soil pipeline.

SUGAR CRYSTALLIZER

TO MEET the need for a rapid-type crystallizer for the batch processing of low raw fillmass in American sugar factories, the Stearns-Roger Mfg. Co., Denver 2, Colo.,

Manual preset interval timer



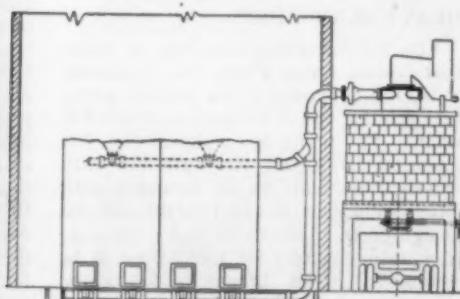
has developed and announced a new machine which has now been operating for several months at the Rocky Ford, Colo., plant of American Crystal Sugar Co. It is believed by the manufacturer that the equipment can readily be adapted also to continuous processing of first and second fillmass. The crystallizer consists of a stationary cylindrical shell with a rotating cooling and reheating element having a total heat exchange surface of 2,000 sq.ft. The working volume is 1,500 cu.ft. Auxiliary equipment consists of a special design of heat exchanger, a water circulating system and automatic cycle control and temperature recording instruments.

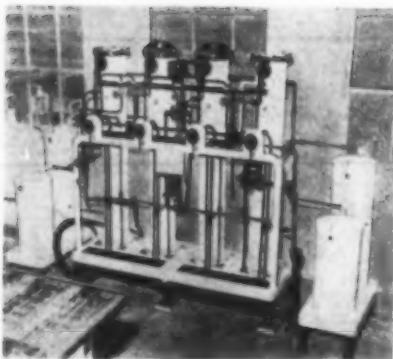
The cylindrical shell has several covered top openings for access. The cooling element, shown in an accompanying illustration, consists of a seamless tube shaft containing the water circulating passages, on which are 144 fan-shaped blades partitioned internally for water circulation. The blades are arranged in six sections of 24 blades each, the circulating water being introduced into the first blade of each section by a pipe extending from the water inlet. Water flows successively to the other blades in each section, then passes out through a hole in the shaft and returns to an expansion tank. About 6 tons of circulating water is used in the system. During the operating cycle it is passed through the appropriate portion of a combination seven-pass heater and one-pass cooler under control of a cycle controller. The charge is first cooled to a predetermined temperature such as 35 deg. C. after which it is reheated to a temperature such as 50 deg. C. before discharge to the centrifugal mixer.

INDUSTRIAL TIMER

MODEL 2500 is the designation of a new manually preset interval timer for industrial applications which has been announced by the Paragon Electric Co., 37 West Van Buren St., Chicago 5, Ill. The device can be preset to allow a given operation to continue for almost any predetermined time limit, at the end of which time the circuit is opened or closed. The

Improved pneumatic ash handling system





Water treater for 2-3 g.p.m. capacity

timer has been developed particularly for use in plastic molding, rubber curing, batch mixing and similar operations. It is powered by a self-starting, slow-speed, synchronous motor clock and is provided with a 1,000-watt capacity fully inclosed single-pole, double-throw switch. Since the act of manually setting the interval stores the energy necessary to trip the switch at the end of the preset time, no energy is required for this purpose from the clock motor. Ten ranges are available, from zero to 15 seconds, through zero to 20 hours. A variety of case types may be had for flush or wall mounting and for single timers or combinations.

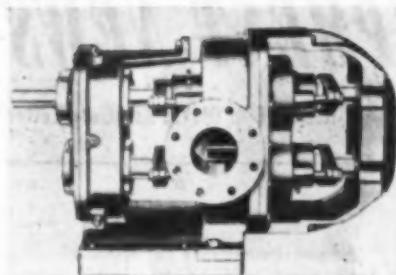
WATER TREATER

Using melamine-derived synthetic resins, American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., has announced the development of ion-exchange water treatment equipment for the production of water approximately equivalent in ion content to distilled water. The equipment, known under the trade name of Filt-R Stil, is available in portable and stationary types designed for a wide range of uses. As in other ion-exchange processes of comparable type, the system employs a resin bed transforming the dissolved salts in the water to the corresponding acids, followed by a second resin bed for absorbing the acids. The product is said to have an average ion content as low as two parts per million expressed as calcium carbonate. The process also removes dissolved carbon dioxide.

Units of any size from a small bench model of 8-10 g.p.h. capacity, to large industrial sizes are available. Larger units employ four beds of alternate cation and anion exchange resins. Smallest units are provided with renewable cartridges of ion exchange resins, while larger units are equipped for reactivation.

HEAVY-DUTY PUMP

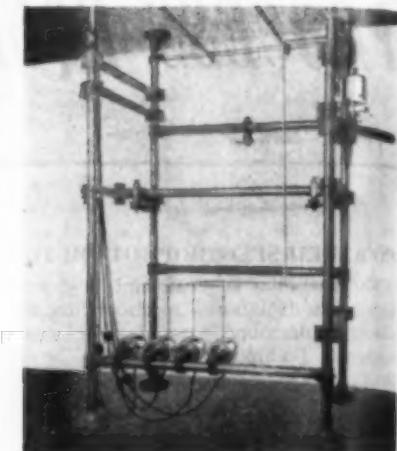
For the heavy-duty handling of industrial liquids, Bump Pump Co., LaCrosse, Wis., has developed a new positive pump for operating speeds between zero and 400 r.p.m. The pump has a capacity of 100 g.p.m. at 100 r.p.m. It is provided with ball bearings and can be furnished with either flanged or threaded intake and discharge ports. Due to its heavy construction, maintenance costs are claimed to be minimized. Iron, bronze, nickel alloys, stainless steel or other metals can be used.



Heavy duty positive pump



Spat for foot protection



Model for pipe stress determination



Elevating lift gate for trucks

FOOT PROTECTOR

For the protection of ankles and feet against acids, alkalis, oils, solvents and greases, a new spat has been announced by American Optical Co., Southbridge, Mass. The spat, as shown in the accompanying illustration, is made from a coated fabric. It is said to give the same protection as rubber, but to be much lighter in weight, as well as extremely flexible. Three snap fasteners at the top and two at the bottom make the spat easily put on and adjusted. A large flare assures overall protection of the instep. Trousers may be worn over the spat, if desired.

PIPE STRESS MODEL

To facilitate solution of its problems in the design of piping systems for chemical and petroleum plants, M. W. Kellogg Co., 225 Broadway, New York 7, N. Y., has developed a precision apparatus for determining stresses in piping systems on the basis of scale-model tests. Measurements are accomplished by means of a series of electrical measuring heads, each containing six gages refined to such a degree as to register deflections of a millionth of an inch. The apparatus employs a rigid framework to support the model which is built exactly to scale, using steel rods of diameters proportionate to the sizes of the proposed piping. The various ends of the model pipeline are attached to the electrical measuring heads, after which the ends of the line are manipulated to correspond to the calculated temperature expansion by moving each measuring head by a micrometer adjustment. The components of the forces set up in each pipe are thus automatically determined by the gages and are

measured by means of a Wheatstone bridge circuit in each gage. Both magnitude and direction are measured at each point. The results are readily calculated to full scale pipe stress.

The method is now being employed in figuring all systems involving more than four pipe ends. A tremendous amount of time is saved as compared with classic methods of calculation which, for example, for a system with ten ends requires the solving of 54 simultaneous equations.

LIFT GATE LOADER

To make loading platforms unnecessary in the trucking of heavy packages and containers such as barrels, crates and steel drums, and to enable one man to handle the loading and unloading, Anthony Co., Streator, Ill., has developed a hydraulic operated device known as the Liftgate Loader. As appears in the accompanying illustration, this device serves as an elevator from ground to truck level and is attached to the rear of the truck. The lifting mechanism incorporates a powerful 5-in. hydraulic cylinder capable of lifting 1,500 lb. It is powered by a take-off from the truck motor. The entire mechanism, including the hoist and its power supply equipment, weighs but 670 lb. After elevating the load, the lift gate then serves to close the rear of the truck in the conventional manner.

FOG-FREE GOGGLE

A NEW TYPE of industrial goggle, developed by Dr. Frank Maurer in cooperation with engineers of the Polaroid Corp., Cambridge, Mass., has been announced.

by the Welsh Mfg. Co., Providence, R. I., sole distributors. The new eye-protective device, known as the Fog-Free, Dust-Free goggle, employs what is said to be a new principle, that of employing the normal breathing of the wearer to act as a natural ventilating pump for the goggle. Approximately once each second the breathing sweeps a complete change of air through flow channels in the frame and across the inner face of the large single plastic lens. This action is said to remove moisture from within the goggle before it can condense on the lens. In addition, the air intake ports contain readily replaceable felt filter pads to remove dust and flying particles from the air, thus affording additional eye protection. In effect the goggle combines features of a goggle and dust respirator. As shown in the accompanying illustration, the air intake ports are at either side of the lens. Outside air is drawn in through the breathing action, across the eyes and into the bulbous nose piece, where it is inhaled through an intake valve. An outlet valve in the bottom of the nose piece permits exhalation without the possibility of reversing the air flow through the goggle.

GLASS CONVEYOR BELTS

EXPERIMENTAL results on neoprene-coated Fiberglas fabric conveyor belts have recently been announced by the B. F. Goodrich Co., Akron, Ohio. The belts carry material averaging 300 deg. F. temperature and operate 24 hours a day, seven days a week, on a factory conveyor line. They are subjected to considerable flexing

New Fog-Free goggle



Multi-belt neoprene-Fiberglas conveyor



and are exposed to contact with oil used as a binder for the material carried. The average life of rubber-covered cotton belt exposed to these conditions has been six weeks. The conveyor line now includes eight of the neoprene Fiberglas belts, $\frac{1}{2}$ in. thick and 4 in. wide. Although one belt was burned through after three months service by a piece of red hot material, a second belt failed after six months and after seven months the six remaining belts were still performing efficiently.

INSULATION GUN

TO SPEED UP the sealing and insulating of refractory walls, Illinois Clay Products Co., 608 South Dearborn St., Chicago 5, Ill., has introduced the Therm-O-Flake Gun which siphons dried Therm-O-Flake insulation direct from the shipping package, mixes it with water and sprays it on to the refractory wall in one operation. Premixing is thus eliminated and application is said to be six to eight times faster than by manual methods. The gun operates on standard air and water pressures, weighs but 4 lb. and can be moved about as easily as a man can walk. Units are shipped complete with 15-ft. sections of air, water and vacuum hose and all the necessary valves and fittings.

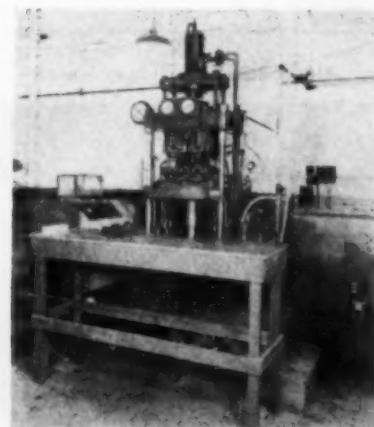
HIGH-SPEED PRESS

TO PERMIT increased output with smaller molds, Baldwin Locomotive Works, Philadelphia 42, Pa., has developed a high-speed molding press intended specifically for use with plastic preforms which have been heated electronically. This press,

Applying insulation with gun



Experimental molding press using electronically preheated plastic preforms



developed through the cooperation of Baldwin's Southwark Division with the Bryant Electric Co., Westinghouse Electric & Mfg. Co. and Monsanto Chemical Co., has already proven successful on small parts. The new press employs a method of squeezing the preheated plastic into the mold and uses changes in mold design said to make high-speed thermo-setting molding practical. It is claimed that the increase in speed is so great that a six-cavity mold in experimental production has turned out 20 percent more pieces than were previously turned out with a standard 24-cavity compression mold, thus permitting a smaller press to be used, at lower initial investment, and resulting in a large saving in mold cost. Since the pressure on the materials molded is reduced, mold life is said to be considerably longer and there is claimed to be a decided reduction in flash, resulting in approximately one-eighth saving in molding materials. The new presses will be available in capacities from 50 to 300 tons.

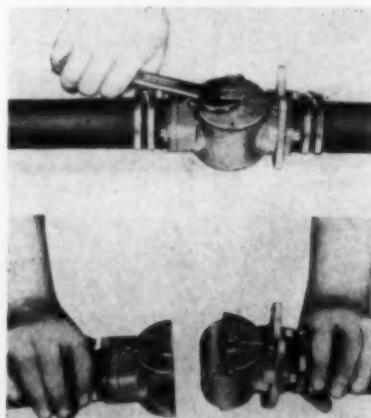
PORTABLE CONVEYORS

TWO LENGTHS, 13 ft. 9 in. and 20 ft., are available in a new light-weight, portable, endless-belt type conveyor known as the Tote-all, which has been developed for handling such products as grain, salt, clay, fertilizers and coal, by the Coaltoter Conveyor Co., 310 South Michigan Ave., Chicago 4, Ill. Both sizes may be driven by either an electric motor or a gasoline engine. Conveyors are equipped with a 14-hp. gasoline engine for most applications, or with a 2.3-hp. engine for heavy-duty work. If desired, the power source can be omitted, the user supplying his own motor.

QUICK DISCONNECT COUPLING

A NEW MEANS for the quick and positive coupling and uncoupling of hose lines carrying various fluids is provided in the Thompson quick-disconnect coupling recently announced by Thompson Products, Inc., Cleveland, Ohio. As will be seen from the accompanying illustration, this device is, in effect, a plug type valve or cock made in two parts designed for coupling together by the same action that opens the valve. The case, and the cylinder or plug of the coupling, are both made in two pieces, so designed that the cylinder

Valve-type disconnect coupling



holds the entire assembly together when it is in the flow or coupled position. Two synthetic rubber seals are provided to make the coupling tight against leakage in both the flow and non-flow positions. These seals seat in guides and are held tightly against the curved surface of the cylinder by springs. Only a one-quarter turn of the cylinder portion is necessary to disconnect the coupling. In this position the coupling separates easily, each half sealing the line to which it is connected. Thus a positive shut-off is provided, preventing leakage even under adverse conditions. However, in the uncoupled position, either half of the line can be drained if desired by opening the half of the coupling attached to that part of the line.

Although designed primarily for use in aircraft fuel applications, this coupling should have numerous possibilities in process plants wherever hose connections are employed.

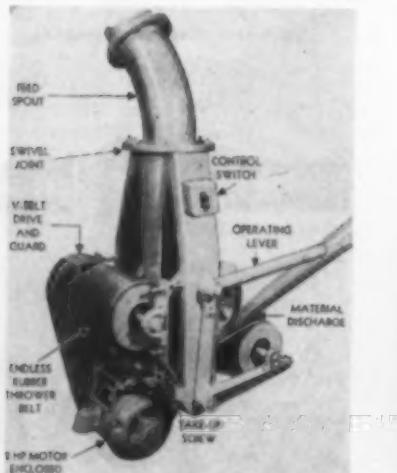
BOX CAR LOADER

FOR THE LOADING and trimming of box cars with loose, granular materials 2 in. and under in particle size, Stephens-Adamson Mfg. Co., Aurora, Ill., has developed a new device known as the Swiveloader. The principle of the machine is similar to that of the company's older centrifugal box car loader, employing a short endless belt operating at high speed to throw material in a stream in any desired direction. The general appearance is different, however, and the loader is installed so that it can be swung into position inside the car door at a point from which all parts of the car can be loaded by simply swiveling the thrower unit on the feed spout from which it is suspended. Since the operator is not required to be in the car during actual loading, dust hazards are reduced to a minimum. The device has a capacity from 40 to 80 tons per hour, handling such materials as grain, salt, fertilizers and coal.

CONCENTRATION CONTROL

FOR USE in many types of application where changes in concentration of solutions are accompanied by corresponding changes in electrical conductivity, Photoswitch,

Swivel-type centrifugal box car loader

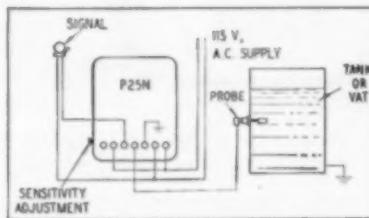


Inc., 77 Broadway, Cambridge 42, Mass., has developed an electronic concentration control requiring only a single probe in contact with the tank. An adjustment on the control housing can be set so that the control relay will operate when liquid of a predetermined electrical resistance contacts the probe. If the probe is immersed in liquid of any other resistance, the control remains inoperative, but when a change in concentration occurs that alters the conductivity to the necessary degree, the electronic control relay is energized to operate a signal, pump or valve. The arrangement is useful, for example, for detecting electrolytes in steam condensate to protect boilers against the entrance of corrosive materials by ways of leaks. An instrument of the same type may also be used for interface level control. The instrument, designated as Type P25N, never requires a probe voltage higher than 25 volts and is designed to operate on a 5 percent change in resistance.

MERCURY VAPOR DETECTOR

INSTANTANEOUS detection of mercury vapor in the atmosphere in concentrations as low as one part in 200,000,000 is accomplished by a new electronic detector developed by the Special Products Division of General Electric Co., Schenectady, N. Y. Designed primarily for use in manufacturing plants where the concentration must be kept below the toxic limit of 1.2 parts per 100,000,000 parts of air for continual breathing, the apparatus nevertheless records concentrations as high as one part in 3,000,000. The instrument may also be used to detect mercury vapor in certain gaseous media other than air provided the spectral absorption band does not overlie the 2,537 Angstrom wavelength. The instrument employs the principle of absorption of ultra-violet radiation by mercury vapor, thus decreasing the illumination of a photoelectric cell. It is easily operated and requires only normal light-line power.

Hook-up of conductivity control



Electronic mercury vapor detector



VACUUM GAGE CONTROL

AN ACCOMPANYING illustration shows a new thermocouple vacuum gage control instrument for the measurement of vacuum in the range from 1 to 1,000 microns, recently put on the market by the Vacuum Engineering Division of National Research Corp., Boston 15, Mass. The instrument, Type E-1, is light and portable and may be carried to any part of the plant where 110-volt alternating current is available. It is used in conjunction with this concern's recently improved Type E all-metal thermocouple gage and may be employed in any part of a vacuum system. It is suggested by the manufacturer that the gage and associated control provide a good method for locating leaks in vacuum systems. The gage is ruggedly constructed and is assembled in a metal envelope with standard 1/2 in. pipe connections.

SAFETY GOGGLE

A NEW TYPE of eyecup said to be considerably larger in area and to conform better to the face than previous eyecups is featured in the improved Duralite safety goggle recently announced by American Optical Co., Southbridge, Mass. The design of the eyecup is such that it will protect the eyes from objects striking from the sides, top or bottom. At the same time a wider angle of vision is provided. The goggles employ a new nasal section and an enlarged facial contact roll to conform to the shape of the face, rather than to force the face to conform to the goggle. Extra comfort is thereby claimed. In addition, air channels at the edges of the eyecups, plus extra side perforations, provide for increased ventilation. The new goggle is designated as Type 301A. Either white lenses or lenses in various shades can be furnished.

High vacuum gage control



Improved safety goggle

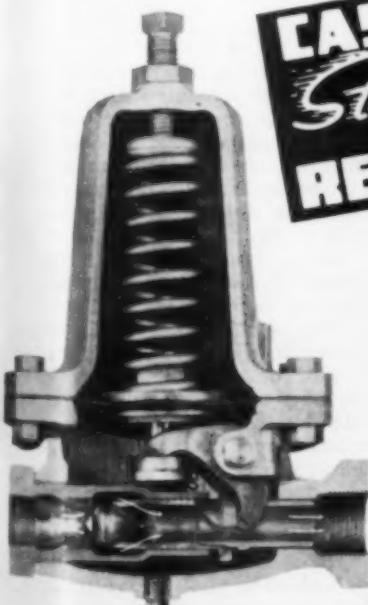


REGULATION...

- "I wanted a valve with a large capacity and close regulation. This valve is doing a fine job for us."
- "Our '1000' Streamliner regulates accurately and has required no attention whatever."
- "We wanted sensitive regulation and the Streamlined Valve gives it to us."
- "Our Maintenance Superintendent has often spoken about your '1000' valve and commented on how well it held its regulation."
- "My object in buying was for close pressure regulation, therefore I choose the LP1000 valve which is giving entire satisfaction."
- "We needed a valve able to handle a large demand and still give good regulation at all times. The '1000' is doing a fine job."

PERFORMANCE

- "We have had no maintenance whatever on these '1000' valves although there are a number of them installed."
- "Your valves have been very satisfactory. They have not required any attention."
- "I've never had to touch one of these '1000' valves after it was installed."
- "We have had your valves in operation for several years and have never required parts, diaphragms, or attention of any sort."
- "We continue to buy your '1000' valves because we must have equipment that requires little or no attention. Your '1000' valves fill the bill."



CASH STANDARD
Streamlined TYPE 1000
 PRESSURE REDUCING VALVE

... and they all talk
 about these points too

SMOOTH OPERATION • TIGHT CLOSURE • ELIMINATION OF FAILURES • CONSTANT DELIVERY PRESSURE • NO SPOILAGE • SPEEDIER PRODUCTION RESULTS • COST-SAVING OPERATION

WRITE FOR BULLETIN "1000"

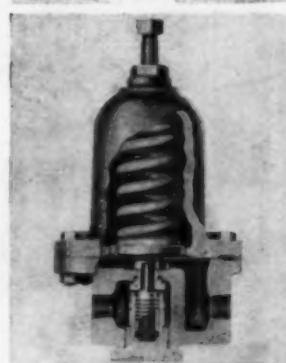
Straight Line Flow: steam, water, air, oil, etc. flow through this valve in a straight line—nothing is in the path of flow to cause turbulence—therefore, peak flow is never a problem.

Bulletin "1000" gives the details.

CASH STANDARD
 CONTROLS..
 VALVES

A. W. CASH COMPANY
 DECATUR, ILLINOIS

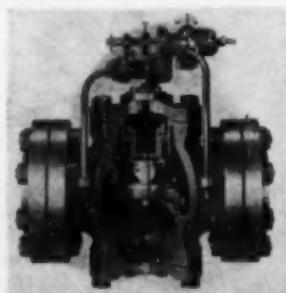
OTHER VALVES
 from the
CASH STANDARD
 LINE



High Pressure Reducing Valve
 Type H-P; extra heavy for use with initial pressures up to 5000 lbs.; and for reduced pressures up to 650 lbs. Good for most fluids. Sizes: $\frac{1}{2}$ " to 2"; bronze body; nitrailley trim. Get Bulletin 931.



Type 8871 Pressure Regulator for
 dirty liquids (like Bunker C fuel
 oil). Inner valve is bolted to dia-
 phragm for positive movement.
 Sizes $\frac{1}{2}$ " to 10". Bodies; iron,
 bronze, or steel. Seat ring and
 inner valve; stainless steel. Bul-
 letin 972.



Cash Standard Type 10 Pressure
 Regulating Valve, pilot operated.
 (Pilot operating fluid discharges
 to outlet pipe; not wasted). Sizes:
 2" to 12". Highest pressures:
 inlet 600 lbs.; reduced 250 lbs.
 Iron, bronze, or steel bodies;
 standard trims. For water, air,
 non-corrosive gases and oils. Get
 interesting Bulletin 966.





VARNISH AND PAINT

IN Brooklyn, N. Y., under a red and blue Army-Navy "E" flag, is the plant of the long-established Hilo Varnish Corp. In addition to the manufacture of the varnish indicated by their name, Hilo also produces paints and enamels. While operations are on a small scale when compared to some of the giants in the paint industry, procedure is continually being modernized and growth is as rapid as present conditions permit acquisition of equipment and man-hours to get it installed. About 85 percent of the Hilo output is now going into direct war uses.

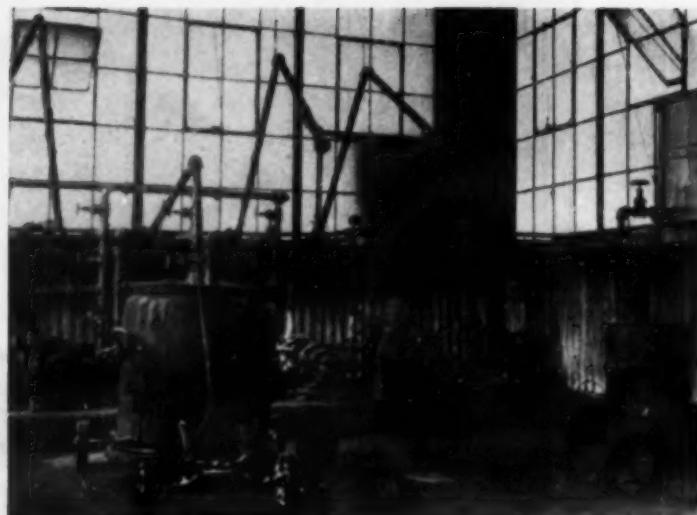
Varnish, reduced to simple terms, is a solution of a resin and drying oil in a volatile solvent. At Hilo, many different types are produced and they all start the same way with subsequent treatment depending on type. Rosin, limed rosin and ester gum are commonly used but modified phenolics and other synthetic resins are gradually replacing the older materials. Most varnish vehicle is now made with dehydrated castor and linseed oils. Oil and resin are measured into the Monel or copper kettles in batches of about 300 gal. Four kettles-full usually are cooked simultaneously at temperatures from 575 to 650 deg. F. for about 2 hr. The varnish is then allowed to cool for 30 min., thinner and drier are added, and then it is pumped to pre-filter storage tanks. A large new tank now being installed at Hilo will

modernize and speed the process by allowing the hot varnish to be added to thinner without waiting for cooling. After filtration, varnish is pumped from base-mint pre-storage to top floor storage and drum-filling.

Paint, in its decorative uses, is older than history. In a modern sense, its production is a series of chemical engineering problems involving mixing, fluid flow, conveying, formulation and testing. Manufacture starts with mixing a paste of pigments and vehicle. Among the most important pigments are: white lead, lithopone, titanium dioxide, chromates, earth pigments, organic pigments, carbon and lamp blacks, etc. Vehicle consists of varnish, oil, thinner and driers, in varying proportions. The paste mix, or semi-paste, flows by gravity to a mill. Buhrstones and five-roll mills are in use in this plant, but the former are being replaced by roll mills as they wear out. From the mills paint goes to large tanks for thinning and tinting. Here it is checked for color, lustre, consistency and drying. It is then strained and packaged in drums, pails and cans. The high-speed mixer shown in the diagram was recently installed as part of the Hilo modernization program. It is used for camouflage and other paints of low reflectivity. Blacks are mixed and ground in a separate room to prevent the very fine pigment from discolored white and light colored paints.



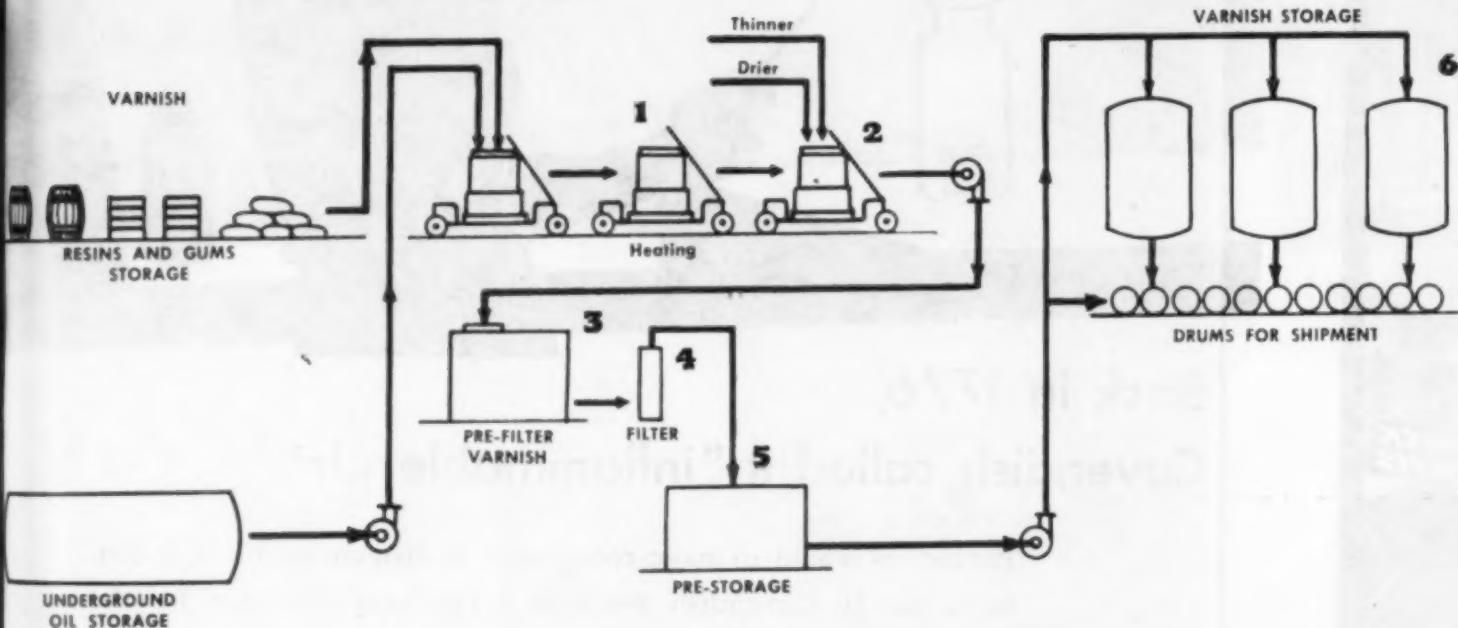
1 First step in varnish making is heating of resins and gums. Varnish type determines heating time and temperature



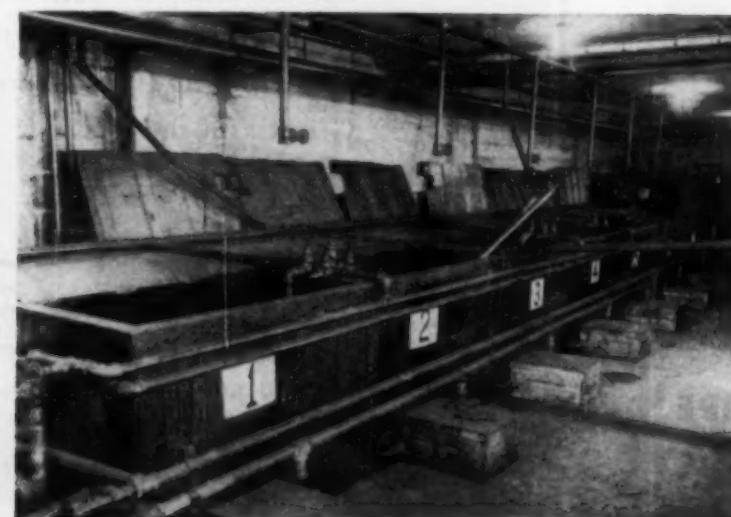
2 Cooked varnish is allowed to cool and, after addition of thinner from measuring tanks (right), goes to pre-filter tanks



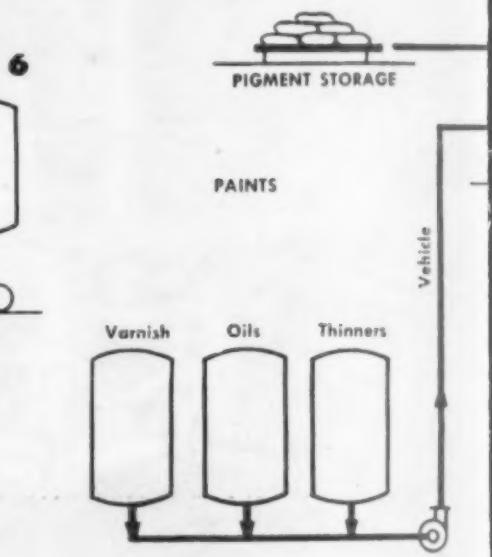
3 Top-floor pre-filter tanks to which varnish goes for intermediate storage. From here it flows down



4 Seitz filter presses used for clarification of varnishes; screens are Monel and asbestos is employed as filter medium



5 Basement pre-storage tanks. Any necessary modifications of the formula are made here before pumping varnish up to storage



6 Top-floor varnish storage tanks for the product are constructed of tin and may be tipped





3 Top-floor pre-filter tanks to which varnish is pumped for intermediate storage. From here it flows down to the filters



7 Paste mixing equipment — the beginning of the paint-making process. Vehicle and pigment are mixed to form a paste.

of

ss

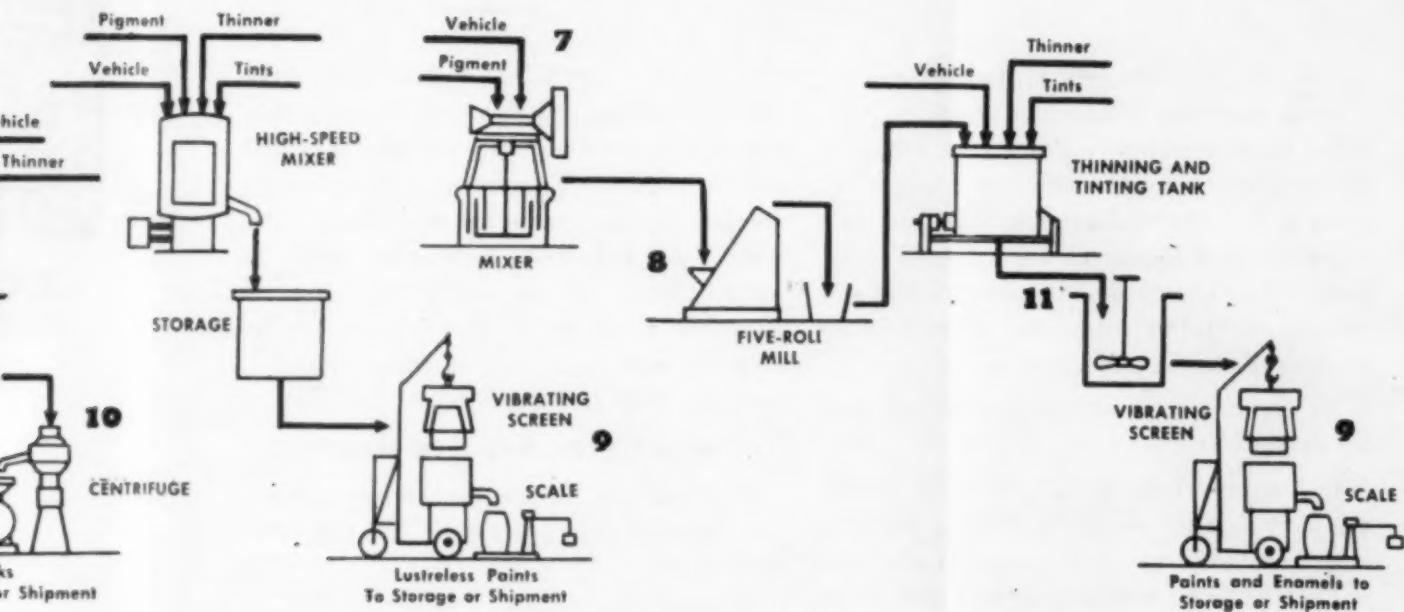
AGE



the beginning of the paint-making
are mixed to semi-paste for grinding

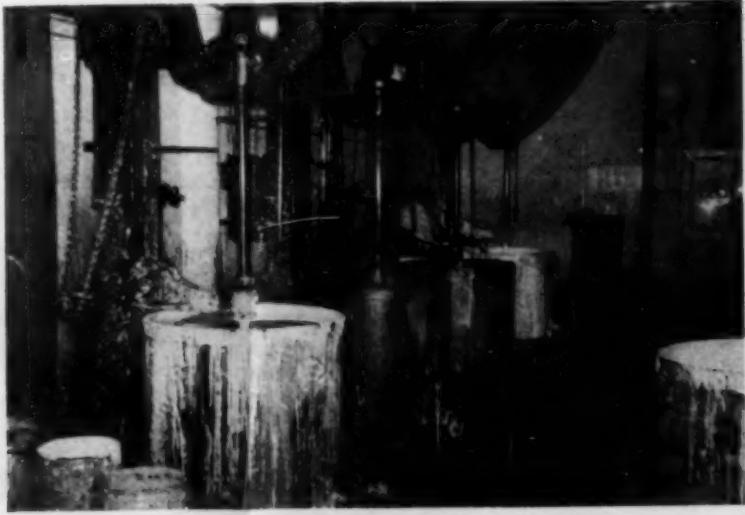


8 Five-roll mill on which agglomerates are
broken up and further dispersed in vehicle



10 Centrifugal clarifier used for blacks. Screens
are too coarse for use with these fine pigments

11 Battery of "change-can mixers" used for making small batches of
paint from mixed paste, tints and vehicle for small and special orders



JAMES GREGORY



*He conceived
a geometrically correct
REFLECTING TELESCOPE
but couldn't
build it*

IN 1663 when he was only 24, James Gregory, Scottish mathematician and astronomer, published his treatise *Optica Promota*, an optically accurate account of mirrors and lenses beginning with the re-discovery of the sine-law of Snellius and Descartes which Gregory supported first by mathematical argument and next by careful experiments, followed by an account of a reflecting telescope.

But, he had no means of constructing such an instrument.

In London where he went in hopes of finding an optician capable of making his telescope, Gregory met Collins and Hooke who put him in touch with a celebrated craftsman, Reiye. An attempt was made but the resulting mirrors were a failure and the project was abandoned. Later, Hooke succeeded and in 1674 presented the first Gregorian telescope to the Royal Society.

If Gregory had been looking for someone to construct his telescope *today*, he might well have taken his project to Perkin-Elmer. For

it has been the privilege of Perkin-Elmer to collaborate in the invention, construction, and improvement of many optical instruments and elements. Perkin-Elmer scientists and engineers have been working successfully with leaders of Industry, Education, and the Armed Forces to make possible the mass production of instruments of even greater accuracy for war-time and *post-war* industrial analysis, control, inspection, and observation.

WHAT PERKIN-ELMER MAKES

Perkin-Elmer serves the optical sciences that broaden man's horizons by supplying them with:

Custom-built optical instruments for industrial analysis, control and inspection.

New optical devices to solve specific problems, such as the all-purpose infrared spectrometer.

Special elements such as fine lenses, prisms, flats, photographic objectives, interferometer plates, retardation plates, Cornu prisms, Rochon prisms, Nicol prisms.



THE PERKIN-ELMER CORPORATION
GLENBROOK · CONN.

Where the Call is for Piping Materials

.... CALL ON CRANE

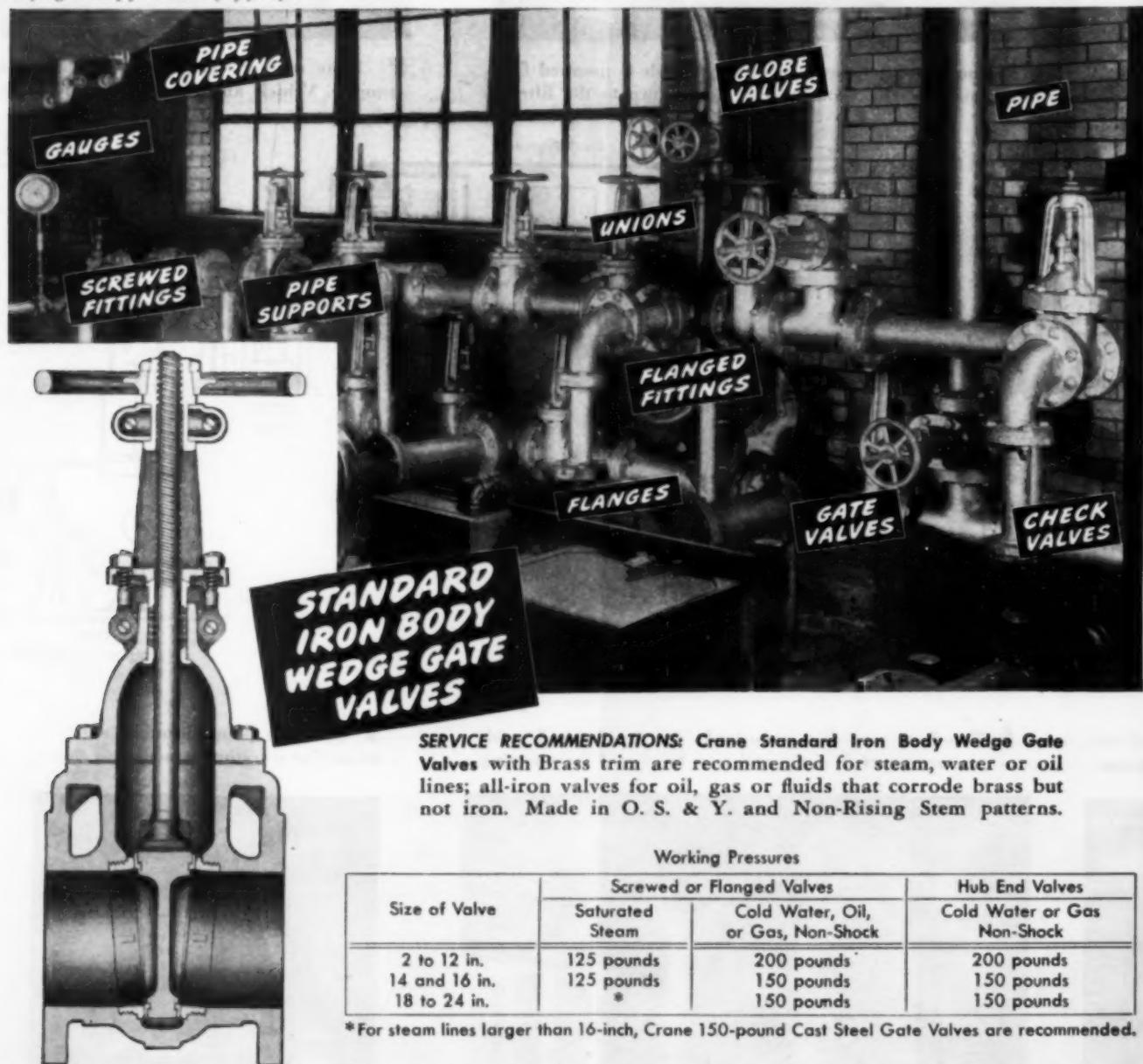
ONE SOURCE OF SUPPLY

ONE RESPONSIBILITY FOR ALL PARTS

ONE STANDARD OF QUALITY

Piping hook-up for a battery of pumps

No matter what you need in piping materials, you can get them *all* from a single source—your Crane Branch or Wholesaler. There, the world's greatest selection of piping materials—in brass, iron and steel—is at your service. Uniform quality in every part—backed by a single responsibility—helps assure the best installation. Take advantage of Crane *complete* piping materials service to speed up deferred replacement work and keep pipe lines at peak efficiency. Crane has everything you need; for example, in Standard Iron Body Wedge Gate Valves, as shown below.



SERVICE RECOMMENDATIONS: Crane Standard Iron Body Wedge Gate Valves with Brass trim are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O. S. & Y. and Non-Rising Stem patterns.

Working Pressures

Size of Valve	Screwed or Flanged Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil, or Gas, Non-Shock	
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

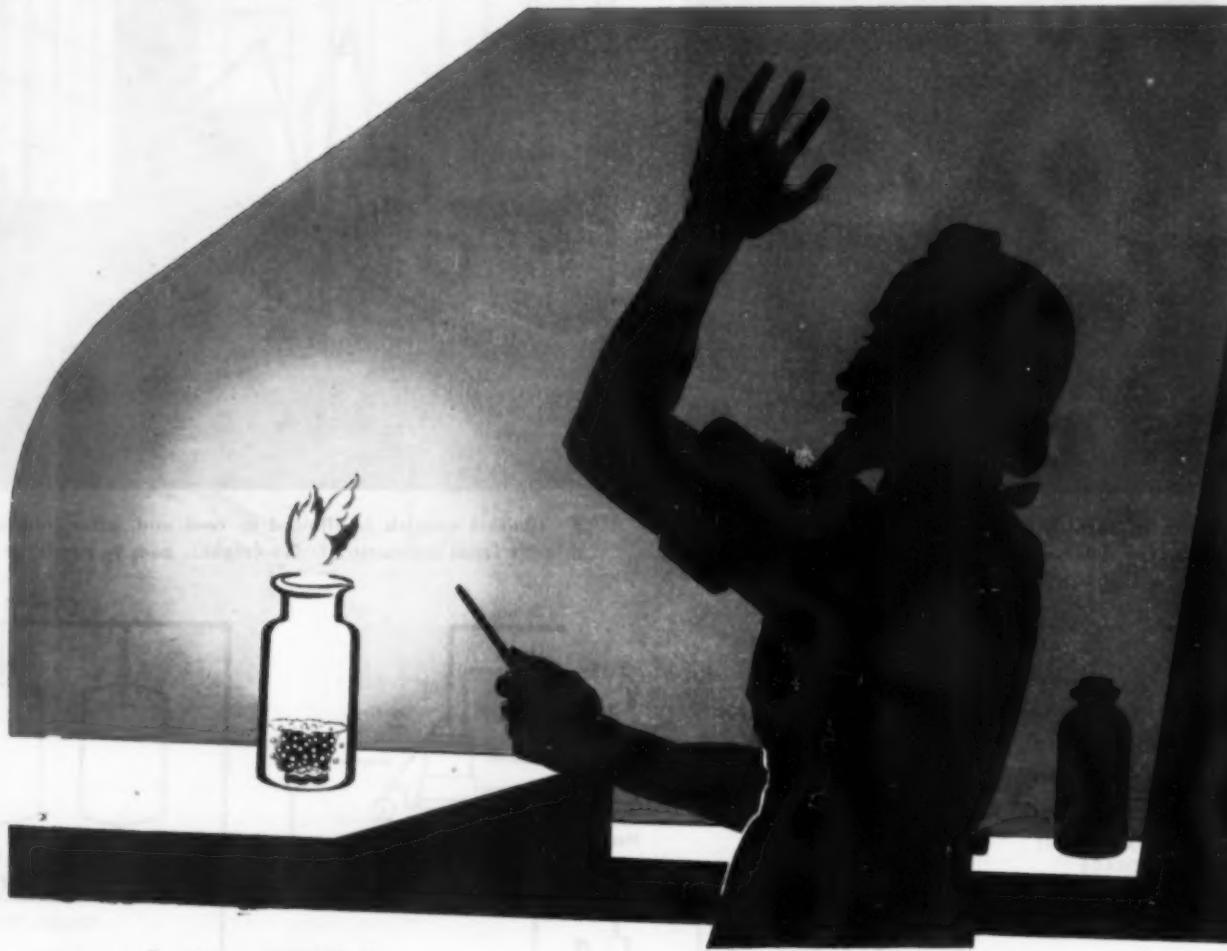
*For steam lines larger than 16-inch, Crane 150-pound Cast Steel Gate Valves are recommended.

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VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS



Back in 1776, Cavendish called it "inflammable air"

Paracelsus is said to have recognized hydrogen in the 16th century, but H. Cavendish *produced* it two centuries later, by the action of hydrochloric acid on metals, naming it "inflammable air." Today Girdler engineers qualify as authorities on the production and purification of hydrogen. Their experience is at your service. Leading chemical manufacturers and refiners, when confronted with a gas processing problem, make it a rule to "Get Girdler on the job."

● Girdler offers processes for gas manufacture, purification, separation and dehydration. Consult us on your problems concerning hydrogen sulphide, carbon monoxide, carbon dioxide, natural gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen.

Originators of the Girbotol Process



The GIRDLER CORPORATION
Gas Processes Division, Dept. CM-3, Louisville 1, Ky.

NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

LIGHT-FAST DYE

LATE LAST year the Tennessee Eastman Corp., Kingsport, Tenn., introduced a series of dyestuffs, designated LF and developed primarily to provide fastness to sunlight. The series will eventually include a large variety of colors, but only two, a yellow and a blue, were made available when the new series was first announced.

A third dyestuff, Eastman Fast Yellow 4RLF, has now been added to the LF line. It produces bright golden shades of yellow on cellulose acetate rayon. In pastel shades, 25 to 40 hour light fastness is obtained; and, of the fast-to-light acetate yellows, this dye is said to be one of the fastest with respect to washing. High resistance of dyed pieces to sublimation and perspiration is also claimed.

Eastman Fast Yellow 4RLF dyes over temperatures ranging from 160-190 deg. F. It leaves cotton and viscose white and is suitable for cross dyeing. It is recommended by the manufacturer for the dyeing of drapery and other fabrics which require extreme fastness to light and gas fading.

RESIN TO PRODUCE HARD SYNTHETIC RUBBER COMPOUNDS

ONE OF THE most difficult problems confronting the synthetic rubber industry in its rapid advance is the processing of synthetics to reproduce the characteristics and properties of hard and semi-hard rubber stocks as produced from natural rubber. Because of the peculiar stiffness of synthetic rubber as compared with natural rubber during such processing, it has been extremely difficult to add sufficient loading during the milling to produce the semi-hard and hard rubber stocks. In the production of the stocks from natural rubber this loading with reinforcing materials such as carbon black was not a problem because of the natural plasticity of the rubber on the mill.

A thermosetting phenolic resin is now being produced by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y., which, according to that company's assertion, gets around the difficulty very nicely. Not only does it soften synthetic rubber during the milling operation but, being thermosetting and completely compatible with synthetic rubber, it further serves to reinforce the rubber in much the same manner as carbon black. It is said, therefore, to produce stocks of high tensile strength, a high degree of hardness, good elongation and low-temperature flexibility. To date the use of this resin has been confined to buna-S and buna-N, but it is known that the resin is also compatible with neoprene and natural rubber.

Depending entirely upon the amount of resin used, the quantity of reinforcing

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agents normally required to give a definite hardness can either be entirely eliminated or reduced proportionately. For example, a buna-N stock having 50 parts of Durez resin in 100 parts of rubber, plus normal sulphur and accelerator content, results in a vulcanizate having a hardness of 92, a tensile strength of 2,600, an elongation of 300 percent, and sufficient low temperature flexibility to pass the ASTM freeze test easily without breaking. A smaller proportion of the resin might have been used to soften the compound on the mill and carbon black added in sufficient quantity to secure the hardness.

Hard rubber stocks machine readily and are said to be benefited in point of resistance to oil, heat and oxygen by the addition of the inherently resistant resin.

Claim is not made that the new hard and semi-hard rubber stocks are superior to those made from natural rubber, but the point is stressed that such stocks having uniform and balanced properties may now be processed from synthetic rubber.

CERAMIC CAPACITOR DIELECTRIC

AN IMPROVED grade of Mycalex electrical insulation, designated Mycalex Series K, has been developed and is now in production by the Mycalex Corp., Clifton, N. J. Chief advantage offered by the new ceramic material is that it offers a selective range of dielectric constants, from 8 to 15 at one megacycle. In other words, the material can be supplied in various values as to dielectric constant. For example, in applications requiring a dielectric constant of 10, engineers will specify Mycalex K-10. If a dielectric constant of 8 is desired, the application will call for Mycalex K-8.

Mycalex K-10 has been approved by the

Army and Navy (JAN I-12) as Class H material. "Other Class H materials are available," according to a company official, "but to the best of our knowledge these are all steatite or bonded titania or titanate types, available only in relatively small dimensions and subject to rather wide variations in tolerance." Mycalex K, on the other hand is available in thicknesses of $\frac{1}{8}$ to 1 in. in 14x18-in. sheets; thicknesses down to $\frac{1}{32}$ in. in smaller sheets; and 14-18-in. rods, $\frac{1}{2}$ to 1 in. in diameter. It is readily machinable to all but the most complex designs, and can be molded, with the incorporation of metal electrodes or inserts where desired.

CHLORINATED PARAFFINS

THE PRODUCTION and use of chlorinated paraffins are not new, and these materials containing as high as 70 percent chlorine by weight have been known for many years in the laboratory. However, it was not until World War II that large-scale commercial production of 70-percent chlorinated paraffin was achieved. Heretofore, the standard, commercial chlorinated paraffin was a liquid containing about 40 percent chlorine. The advantages of increasing the chlorine content to 70 percent are said to be as follows: the material is obtained as a resinous solid; it is somewhat more stable; it is compatible with a very large number of film-forming materials and can therefore be combined to produce fire resistant films; and finally, its potency as a flame retardant is considerably greater than that of the liquid paraffin.

Large quantities of this improved material are being produced by the Diamond Alkali Co., Pittsburgh, Pa., under the trade name Chlorowax. The entire output is now going to the war effort, and 90 percent of it to the treatment of cotton duck for army tents. However, 200 lb. samples are available without allocation to the producers of civilian goods.

In most of its proposed applications, it is the ability of Chlorowax to impart flame resistance which will be utilized. It has already been so used as an ingredient in coating compounds which may be applied as paint or as textile finishing compositions. Its solubility in drying oils and its compatibility with the other ingredients of linoleum make its incorporation in linoleum formulas entirely feasible. It may also be incorporated in electric cable coating compositions where, in addition to imparting flame resistance, it is said to increase the hardness of the coating and to give it greater resistance to abrasion. Important also in connection with cable covering is the report that Chlorowax does not cause skin irritation or organic disturbances.

Apart from its action as a flame retardant, Chlorowax is said to improve the adhesion of lacquers and similar coating

materials to metal, glass and wood. This is especially valuable in situations in which peeling of the lacquer film from the coated article would expose the metal to corrosion. When it is further noted that Chlorowax has excellent resistance to chemicals under ordinary conditions, it becomes evident that this material should prove to be of considerable value to the manufacture of waterproof and flame resistant glues and adhesives.

Physical Properties of Chlorowax

Appearance.....	Cream-colored powder
Molecular wt., approx.....	1060
Sp. gravity.....	1.62-1.70
Chlorine content, %.....	69-73
Solubility.....	Insoluble in water Soluble in a variety of organic solvents

CHEAP THIOPHENE

ACCORDING to the Socony-Vacuum Oil Co., New York 4, N. Y., we may look forward to the opening of new, unexplored fields in chemistry—especially in plastics, pharmaceuticals, and dyestuffs—as a result of an inexpensive method developed by that company for producing thiophene from petroleum. Thiophene is a colorless liquid, heavier than water, boiling at 183 deg. F. Its odor resembles somewhat that of benzene. Chemically it has the empirical formula C_4H_6S , its structure consisting of a five-membered ring containing four carbon atoms and one sulphur atom. The ring contains two double bonds between two of the pairs of carbon atoms. One hydrogen atom is connected to each carbon atom.

In its reactions thiophene resembles benzene, although different reaction conditions may be necessary. Dyes, pharmaceuticals, plastics and a host of other chemical commodities are derived to a large extent from benzene and its compounds. Thiophene, therefore, permits the preparation of many of these products, but with the thiophene ring substituted for the conventional six-carbon-atom benzene ring. This fact presents numerous opportunities for altering the characteristics of many products such as the color of dyestuffs, the physiological effects of medicinals, and the hardness, elasticity, brittleness and many other properties of plastics.

Under certain conditions, thiophene also reacts with aldehydes, particularly formaldehyde, to form thermosetting resins. In this respect its behavior may be likened to that of phenol although there are important differences. Nevertheless, in the condensation of phenol with aldehydes it is possible, under suitable reaction conditions, to replace phenol with thiophene in any proportion.

In the past, small quantities of thiophene have been made available—at \$54 per lb.—for laboratory work by intricate and costly chemical synthesis. Now this chemical will be made available as a commercial product and at a price which will be commercially attractive. The process of manufacture is economical and raw materials are plentiful. Socony-Vacuum is now operating a small laboratory pilot plant unit, and a larger pilot plant is being constructed having a capacity of several barrels per day. The company plans to make samples of thiophene available in order that its potentialities may be explored.

EMULSION-TYPE RESIN ADHESIVE

A NUMBER of resinous emulsion adhesives have been developed for wartime applications by the National Adhesives Div. of National Starch Products, New York, N. Y. One is used for applying and overcoating labels on fiber and wooden containers for overseas shipment. It complies with pertinent government specifications, and is characterized by its clear film, excellent water resistance and fast setting properties.

Others in this group are designed to provide certain properties which are desirable for specific applications. One type offers high setting speed and forms clear films with excellent resistance to heat and water. Still another, as yet in the experimental stage, permits the reuse of sealed fiberboard cases by virtue of the fact that the bond formed may be broken without destroying the container. Very shallow penetration of the adhesives into the container stock makes this possible, so that a purposeful "yank" or prying action on the flap will cause a clean break without tearing the inner liners. Though the seal may thus be broken open easily, it still has sufficient strength to withstand abuse in domestic transit. This adhesive may be diluted with water, and like the others is applied cold by brush or in automatic sealing machines. While neither its heat nor its water resistance is as good as some of the films formed by other adhesives in the group, it is adequate in these respects for the purpose.

Still another interesting formulation is used as a laminating agent for cellophane-to-paper bonds—for example, in the manufacture of cellophane-lined tubes. Like the others, this adhesive is applied cold, but lends itself to either pressure or heat sealing of precoated surfaces and provides a film of outstanding flexibility at room temperatures. It is of medium fluid consistency and, since it contains solvents, it is suggested for use on stocks which are not readily adhered by purely aqueous glues.

GLUE FOR PALLET-LOADING

QUICK-SETTING, mold-proof glue for palletizing fiber, wood, or corrugated shipping containers is now available from National Adhesives, New York, N. Y. Identified as Pallet Adhesive No. 4, it was developed in collaboration with the Quartermaster Corps and is designed to provide high shear strength in combination with low tensile strength. Strength in shear prevents side-slipping of the units comprising the load; weakness in tension permits easy separation of the cases at their destination. Application is made by brush, first to the perimeter of the wooden pallet face, and then to the upper four corners of each container as one layer of containers is stacked on top of another. In the case of wooden containers pieces of chipboard are smeared with glue and inserted between layers. The glue is said to be both inexpensive and readily available.

The gluing of pallet loads will probably expand the practical application of palletizing to a far greater number of shippers. It will permit those without mechanical handling equipment to assemble unit loads in freight cars and forward them safely to any

point in the United States without a single steel strap. The company states that test hauls have proven that their Pallet Adhesive No. 4 provides adequate protection against all the stresses of domestic shipping and freight handling. In addition, palletizing with glue reduces losses due to pilferage and, by preventing the slippage of inadequately anchored items, eliminates the need for reassembling broken loads.

For overseas shipment, three steel straps, instead of the usual six, can be relied upon to withstand the rigors of shiploading if they are augmented by gluing. The saving in scarce steel strapping may thus amount to 50 percent of the requirement of the Service Forces for export. It is said that the use of glue to hold pallet loads together has worked out so successfully for the Army Service Forces and Navy Department (Bureau of Supplies and Accounts) that all branches of the armed forces are studying this system in relation to their special shipping problems.

SYNTHETIC WOOL

A NEW synthetic fiber which is wool-like, but does not shrink and is not attacked by moths, has been developed in England by Imperial Chemical Industries, London. The material is known as Ardil and is produced from the protein of peanuts. It is a cream-colored, crimped, resilient fiber which is soft and warm to the touch. Fabrics containing 50 percent Ardil and 50 percent wool are "scarcely distinguishable" from pure wool. It dyes like wool, absorbs moisture like wool, and has a similar heat of wetting. It has felting properties—not, however, because of scales on its surfaces like wool and fur—but because it molds and welds under heat and pressure. Fabrics have been made purely of Ardil, but its best use is likely to be in combination with wool or rayon.

It takes about a ton of peanuts to make 500 lb. of Ardil fiber. After the oil is extracted for human food and high-grade soap, the oil-free meal is treated with dilute caustic soda. Protein thus extracted is precipitated with acid, then redissolved with caustic soda and forced through spinnerets into a hardening bath where careful lowering of pH causes the protein to precipitate. The fine filaments obtained may be cut into any lengths and may be mixed with wool, cotton, or rayon. Yarns can be made on the worsted, woolen or cotton systems. Production of Ardil has been curtailed by the war so that not even samples are available at present, but Ardil is expected to be cheaper than wool, so commercial exploitation will probably commence as soon as possible.

RUBBER CEMENT

ANNOUNCEMENT has been made by the B. F. Goodrich Co., Akron, Ohio, of a new rubber cement, named Plastilock 500, to be used for bonding metals, wood, plastics and ceramic materials to themselves or to each other. It is nonthermoplastic and is resistant to water and aromatic oils.

Bond strength varies with the materials being adhered. Used for metal-to-metal bonding, the adhesive is said to have shown a shear strength of 3,250 psi. and a tensile strength of 4,000 psi. Tests to destruction

TWINS AVAILABLE

The twin compounds, cyclohexylamine and dicyclohexylamine, can be shipped immediately... in commercial quantities... by Monsanto.

Cyclohexylamine has applications in the fields of corrosion inhibitors, paint film solvents, emulsifying agents, petroleum, dyestuffs and chemical manufacture. It has possible uses in the manufacture of plasticizers, as a curing agent for soya bean molding powders, as a color stabilizing agent in vinyl resins, in dry-cleaning soaps, as a blending agent for alcohol-gasoline mixtures and in the manufacture of insecticides.

(These suggested uses are for illustration and are not to be construed as recommending violation of any patent.)

CYCLOHEXYLAMINE

(Also known as hexahydroaniline)

Clear, practically colorless liquid.

Distilling Range 132.0 to 137.5°C
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Flash Point (by "Tag" open cup) 90°F
Fire Point (by "Tag" open cup) 90°F

Cyclohexylamine is a primary amine, being more aliphatic than it is aromatic in nature.

Dicyclohexylamine is used in extreme-pressure lubricants, in the manufacture of cutting oils and in the production of chemicals. Some derivatives have special application as insecticides.

For technical data, and samples of these low-priced alicyclic amines, contact the nearest Monsanto office or mail the coupon to **MONSANTO CHEMICAL COMPANY**, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

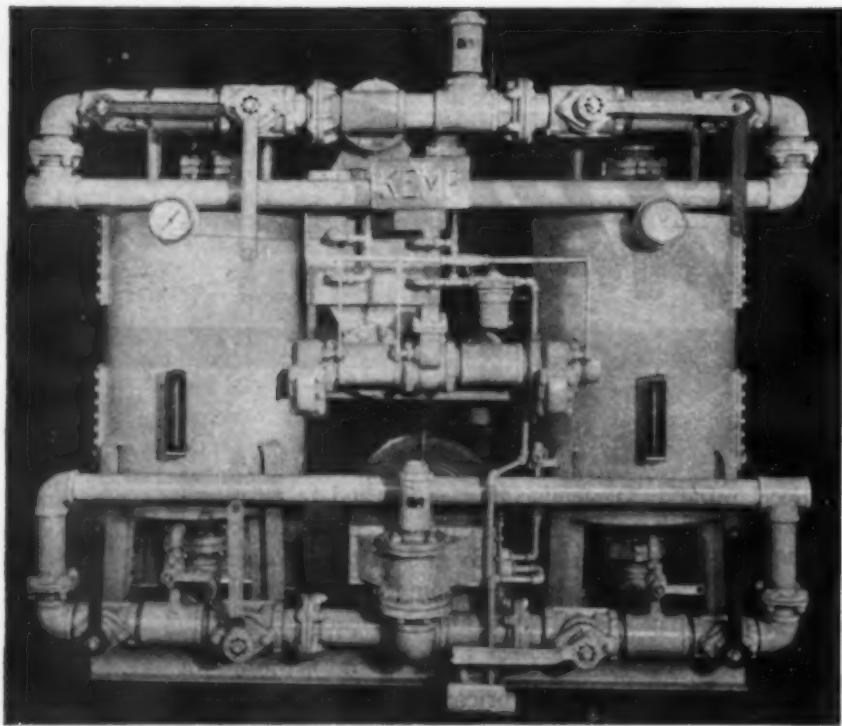
DICYCLOHEXYLAMINE

Clear, practically colorless liquid.

Distilling Range 252.0 to 258.0°C
Sp. Gr. at 15.5/15.5°C 0.916 to 0.920
Flash Point (by "Tag" open cup) Above 200°F
Fire Point (by "Tag" open cup) Above 200°F

Dicyclohexylamine, a strong base, is only slightly soluble in water. It is soluble in all common organic solvents.





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K E M P of BALTIMORE

on wood-to-aluminum and plastic-to-aluminum joints have resulted in failures within the wood or the plastic rather than in the joint itself. This is significant in view of the difficulty normally experienced with aluminum in bonding it to other materials.

The company recommends that heat and pressure be applied in using Plastilock 500, although heating alone will give some degree of adhesion. The recommended procedure is as follows: After removing dirt, grease and scale, apply three coats of adhesive to each surface and dry each coat at room temperature for at least 1 hr. If thinner is required, use denatured alcohol. Assemble and preheat for 30 min. at 250 deg. F. or for only 10 min. at 350 deg. F. Then apply sufficient pressure to get good surface contact and heat for 45 min. at 250 deg. F. or for 12 min. at 350 deg. F.

PRE-PLATING DIP FOR METALS

ACCORDING to Macco Products Co., Chicago, Ill., a new product, Mac Bond, now being manufactured by them can be used to advantage to replace the pickling acid normally used to prepare ferrous metal surfaces for electroplating. Mac Bond is a liquid and is furnished in carboys. Usually it is mixed with twice its volume of water to prepare a solution into which is dipped the ferrous metal which is to be plated. This solution is easily controlled and is extremely long lived so that uniform results may be obtained over a long period of time.

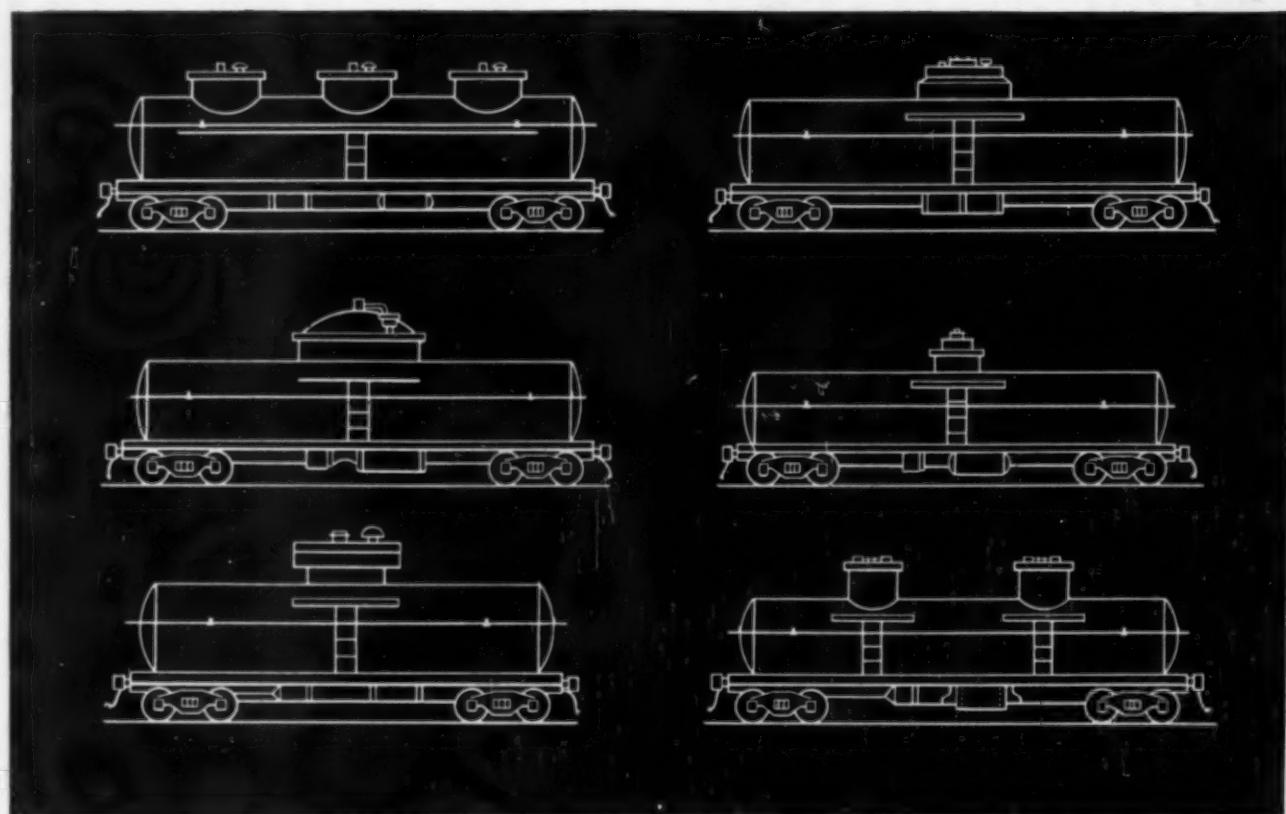
Use of the treatment requires no change in the average plating cycle other than the substitution of Mac Bond in place of the acid. The several advantages which are claimed are as follows: (1) better adhesion of the plate to the steel; (2) less porosity of the plate; (3) faster deposit of the plate on the metal after being placed in the plating bath.

RESIN COATED VOILE

TEXTILE chemists have long emphasized the market need for sheerweight fabrics which would also be strong and air-resistant, thus providing strength and warmth without weight. Prior to the advent of the vinyl resin coatings, however, there was little evidence of real progress in that direction. Thus, the development of vinyl resin coated fabrics represents one of the outstanding contributions of wartime textile processing to postwar consumer markets.

One of the more interesting of these fabrics is a rayon voile, developed by the Athol Mfg. Co., Athol, Mass., and now being produced by that company for military use. This very light weight vinyl resin coated cloth is said to have exceptionally good water and wind resistance and to provide a high degree of warmth rarely found in a sheer fabric. According to the company, the two major advantages of the Terson Brand rayon voile are as follows: (1) The coated cloth, ready for use, has a total weight of only 2 ounces per square yard; and (2) it will stand 10 lb. hydrostatic pressure as determined by the Mullen test. At present, Terson Voile is available for development purposes only and in only one color—transparent. However, laboratory work indicates that it has

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THE COLD-APPLIED PLASTIC

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A COAT of Tygon Primer and a few top coats of Tygon Paint applied to exteriors of tanks, pumps, fume hoods, ducts, pipe, exposed structural work—in fact, any place where danger of corrosion from acid spillage, gases or condensates is prevalent—gives lasting protection against almost all acids and alkalies.

Tygon Paint is a liquid formulation of Tygon sheet stocks, the rubber-like plastic used to line acid tanks. While thin (as any paint film) compared to a 3/32" thick Tygon lining, Tygon Paint possesses the same basic corrosion-resistant properties of Tygon sheet stocks. Tygon Paint films are tough and flexible. They are resistant not only to most chemicals but to water, oil, grease and alcohols. Like other Tygon formulations Tygon Paint is not subject to oxidation, will not chemically deteriorate with age.



Tygon Primers and Tygon Paints are applied cold with spray gun or brush. May be applied to any clean metal, wood or concrete surface. May be air-dried or baked.

•

Tygon Paint is available in white, black, clear, grey, green, red and aluminum. In requesting samples (available without charge for test in your own plant under your own conditions) please give full details as to the proposed use: corrosives encountered, temperature, and nature of surface.



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OTHER FORMULATIONS OF TYGON FLEXIBLE PLASTICS

TYGON LININGS—Tygon sheet stocks are used to line acid handling and storage tanks, blowers, valves, pipe, fume ducts, and other equipment exposed to severe corrosive conditions. Tough, sturdy, highly resistant to abrasion, Tygon linings bond to steel with almost integral adhesion.

TYGON GASKETING—for effective pressure-tight seals in chemical handling service. Tygon gasketing is available in sheets, in extruded tubes, rods, strips, ribbon or tape from which you can cut your own gaskets, or Tygon gaskets may be molded to your exact specifications.

TYGON TUBING—a tough, flexible tubing for air, gas, or fluid transmission. Translucent or opaque, in diameters up to 1 1/4", and in varying wall thicknesses. Formulation S-22-1 is ideal for laboratory use: flexible and elastic for easy connections, and clear for solution visibility. S-22-1 may be steam sterilized.

TYGON MOLDED ITEMS—Tygon molds much the same as rubber. Physical, chemical and electrical properties may be varied within a wide range to suit highly individualized requirements.

an excellent affinity for dyes and that, once the necessary dye chemicals are released from war work, it will be available in various colors including pastels. The coated cloth can be made in all grades of synthetic fiber or cotton, and super-strength is said to result when the voile is made of Nylon.

One of the largest uses to date has been for rain covers for naval officers' caps, but experiments have demonstrated its worth in such diversified fields as women's rain wear, clothing bags, shower curtains, and moisture-resistant covers for containers for icebox use.

PROTECTIVE DIP

METAL PARTS for overseas or interplant shipment may be protected against corrosion and mechanical scuffing by dipping them prior to packing in a film-forming gelatin-base material called Dunnflex, produced by Thomas W. Dunn Co., New York, N. Y. The finished metal parts are first coated with oil, then with Dunnflex. Oil provides the actual corrosion resistance, while Dunnflex holds the oil film intact and provides a tough physical barrier against mechanical damage.

Dunnflex comes from the manufacturer in the form of solid slabs. To these hot water is added and the solution held at the comparatively low temperatures of 110 deg. F. for dip application or 145 deg. F. for spray gun application. The applied film remains tacky until it cools to room temperature, so where immediate packing is desired the freshly dipped parts must first be coated with finely chopped cotton flock, either with a flock spray gun or by tumbling.

When hexamethylenetetramine, a light-sensitive salt, or any aldehyde is added to the solution, the film polymerizes and becomes non-remeltable and insoluble in water. This action may be rushed to completion in a few minutes if necessary, but even when no special steps are taken to speed polymerization, the action is completed within seven days. The insolubilized skin will withstand exposure to -40 or 160 deg. F. and is impervious to salt water, air, and all liquid hydrocarbons.

Production of Dunnflex amounts to about 15,000 lb. daily and the price is 18-32 c. per lb. Tight, but non-critical, raw materials are used.

CARBON REMOVER

A NOVEL application for a product derived from lignin is revealed in the announcement of the Carboblast process by the Turco Products, Inc., Los Angeles, Calif. Small, ligno-cellulose pellets are used as "ammunition" in conventional sandblasting equipment, the object being to knock loose the residual carbon, oxides, and gums which have to be removed whenever an automotive engine is to be cleaned or reconditioned after long service. Normally, prolonged soaking in special chemicals is required to completely remove tenacious deposits from pistons and other parts, but by supplementing a short-time bath with the Carboblast treatment, it is possible to get the parts clean in a much shorter time. The ligno-cellulose pellets are soft enough that they will not mar mirror-surfaces, and are small enough to clean thoroughly such

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narrow recesses as valves and screw threads. They are durable and may be used repeatedly. While conventional sandblasting equipment is adaptable to the process, a specially designed cabinet is available. Carboblasting is said to work about as fast as the operator can turn the part to the stream of pellets.

VISCOSITY STABILIZER FOR OIL AT EXTREME TEMPERATURES

A WATER-WHITE, acrylic polymer known as Acryloid HF, a product of Rohm & Haas Co., Philadelphia, Pa., has the very desirable effect of preventing dangerous thickening of aviation oil at sub-zero temperatures. It also checks excessive thinning in tropical heat. By combining this new material with the hydraulic and recoil oils, the aircraft's hydraulic and recoil mechanisms are prevented from freezing up in the extreme cold of stratosphere flight.

With aircraft which climb from tropical temperatures to the stratosphere in a few minutes, the material functions as the means of adjusting the oil to the rapid temperature change. Rohm & Haas is issuing royalty-free licenses to oil companies enabling them to produce new types of hydraulic and lubricating oils.

Acryloid HF has, according to the company, passed laboratory and field tests on stability under continued use and has proven successful in widespread military applications. In addition to its use in aircraft, it is recommended for ships and vehicles operating in frigid climates.

FLAVORING MATERIAL

SINCE its introduction on the market some months ago, Veratraldehyde, the trade name for the methyl ester of vanillin, has proved to be of considerable interest and value to the manufacturers of perfume and flavor materials. It is manufactured from vanillin and is an offshoot of the new lignin process for manufacturing vanillin. The aroma and flavor of Veratraldehyde resemble somewhat that of caramel-maple with a suggestion of heliotropine. When added to the vanilla complex to make vanilla flavor, it is said to add a new note with very delightful results.

Chemically, Veratraldehyde is 3,4-dimethoxybenzaldehyde ($\text{CH}_3\text{O}_2\text{C}_6\text{H}_3\text{CHO}$). Its molecular weight is 166.17. The product forms a solid mass of colorless needles, melting at 44.45 deg. C. and boiling at 283 deg. C. It is slightly soluble in hot water and very soluble in alcohol and ether. Price of Veratraldehyde at present is \$4.50 per lb.

BUTYL BROMIDE AND CHLOROPROPENE

Two new chemicals, iso-butyl bromide and 1-chloro-1-propene, are now being produced by Halogen & Perfume Chemicals, Columbia 52, S.C. Iso-butyl bromide is prepared from the alcohol with sodium bromide and sulphuric acid, a method found to be superior to the usually laborious phosphorous tri-bromide method. It is clear, water-white, insoluble in water, and distills over a two degree range.

The 1-chloro-1-propene consists of a mixture of cis and trans isomers and is interesting for research concerning polymerization, as well as aluminum chloride reactions involving the double bond.

MODERN DEVELOPMENTS OF GASKET RESEARCH

SPIRALWOUND

Type 4-Y



This Metal-Asbestos "Sandwich" Makes Sealing Warped and Pitted Flanges A PICNIC

SPIRALWOUND — an extremely popular gasket for standard or special flanges and boiler tube caps, hand-holes or man-holes — is composed of interlocking plies of preformed metal, cushioned with Asbestos strip, spirally-wound together.

Under compression, the central spring-like corrugation of the metal strip enables the gasket to seal warped or irregular flange faces and provides unequalled resilience to compensate for expansion and contraction in service. In addition to the multiple-sealing action of this metal strip, the Asbestos cushion also fills irregularities in flange faces to assure a tight closure.

SPIRALWOUND Gaskets have great mechanical strength, are highly resistant to corrosion and temperature extremes, have proper compressibility with relatively light bolting. Rugged construction permits re-use a number of times when seals must be broken.

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CHEMICAL ENGINEERING NEWS

ADVISORY BODIES TO STUDY POSTWAR RESEARCH

DIRECTOR of the Office of Scientific Research and Development, Dr. Vannevar Bush, has announced the formation of four advisory committees for study and report in connection with broad problems relating to the fuller utilization of science and research in the postwar world. These studies have been inaugurated in answer to a request made last November by President Roosevelt, who suggested that the experience of OSRD be used in the days of peace for the improvement of the national health, the creation of new enterprises bringing new jobs, and the betterment of the national standard of living.

The President raised four major points and Dr. Bush has appointed a separate committee to study and make recommendations on each of the points. To answer the question "What can be done, consistent with military security, and with the prior approval of the military authorities, to make known to the world as soon as possible the contributions which have been made during our war effort to scientific knowledge?" a committee headed by Dr. Irvin Stewart, executive secretary of OSRD will give its attention. A second committee, headed by Dr. W. W. Palmer, Bard professor of medicine, Columbia University, will study what can be done to organize a program for continued scientific work against disease.

Dr. Isaiah Bowman, president of Johns Hopkins University, is chairman of the body which will recommend how the government can aid research by public and private organizations. Among the members of this committee are Prof. W. Rupert MacLaurin, Massachusetts Institute of Technology; Charles F. MacQuigg, dean of the College of Engineering, Ohio State University; Dr. Oliver Buckley, president of Bell Telephone Laboratories; Dr. Robert E. Wilson, chairman of the board, Standard Oil Co. of Indiana; Dr. C. P. Haskins, president of Haskins Laboratories; Dr. Edwin H. Land, president and director of research of the Polaroid Corp.; and Col. Bradley Dewey of Dewey & Almy Chemical Co. The fourth committee of which Dr. Henry Allen Moe, secretary of the John Guggenheim Memorial Foundation, is chairman, will concern itself with a program for discovering and developing scientific talent in American youth.

In reporting on work done by the Office of Production Research and Development, WPB stated that research projects have been coordinated and expedited by OPRD which made important contributions to increased war production. Projects which it sponsored have developed successful substitutes for scarce tin, light metal alloys, wood pulp, rubber, adhesives, and ship timbers. Donald B. Keyes, director of OPRD, pointed out that its work is measurable not by the amount of research expenditures but by its effect in increasing

and expanding war production. For example, it spent \$200,000 for research on one war project with the result that industry and other government agencies invested an additional \$50,000,000 and the project was brought to a successful conclusion months earlier than otherwise would have been possible.

A partial list of wartime projects completed with the aid of, or under the sponsorship of, OPRD includes the establishment of industrial alcohol production by the Scholler wood-hydrolysis process, the development of mica testing instruments, spectrographic analysis of metals and alloys, a process for producing synthetic quinidine from quinine, methods that increased penicillin production, fluoroscopic inspection of castings, a modified coking process for midwestern coal, and the lamination of timbers for ship construction.

CHEMICAL ENGINEERS FORM CHAPTER IN CALIFORNIA

NOW BEING organized in the San Francisco Bay area is one of the first local chapters of the American Institute of Chemical Engineers west of the Mississippi River. Active organization of the new chapter began in the fall of 1944 and a number of regular meetings have already been held. Attendance has been unusually promising, averaging 90 for the first four regular meetings out of the Institute membership in the Bay area of about 110 and a mailing list of members and potential members of 175. About 25 companies are represented in the new organization, with 12 companies having four or more representatives.

Officers of the organization, which will probably be known as the Northern California Chapter of the AIChE, are as follows: Chairman, C. R. Nelson, Shell Development Co.; vice chairman, O. M. Chinnock, Hercules Powder Co.; secretary-treasurer, M. Souders, Jr., Shell Development Co. The executive committee consists of A. George Stern, Westvaco Chlorine Products Co.; G. C. Gester, California Research Corp., G. H. Hemen, Union Oil Co. of California, and R. S. Trouton, Standard Oil Co. of California. Chairmen of committees organized to date include the following: Program, O. M. Chinnock, Hercules Powder Co.; membership, F. F. Radcliffe, Dow Chemical Co.; regional meeting, C. R. Nelson, Shell Development Co.; publicity, J. R. Callahan, Chem. & Met.

PENN SALT PLANT STARTS DDT PRODUCTION

The Pennsylvania Salt Mfg. Co., Philadelphia, announced in February that it had completed installation of facilities for the manufacture on commercial scale of DDT (dichloro-diphenyl-trichloroethane). Pro-

duction has already begun, all of the output for the present being taken by the government for the use of the Army and Navy. The company stated that as soon as military requirements permit and WPB approves, it will be in a position to supply these materials for preferred civilian uses.

DU PONT TO PRODUCE NYLON AT ORANGE, TEXAS

PLANS for construction of a new plant near Orange, Tex., to produce nylon for military purposes at the specific request of the government, were announced early in March by E. I. du Pont de Nemours & Co. Work on the project, estimated to cost approximately \$20,000,000, is to start at once. The plant, on a tract of about 1,000 acres adjacent to the Sabine river in southeast Texas, is to be about three miles south of Orange and will be called The Sabine River Works.

The company plans that Texas production of the ingredients of nylon will begin in 12 months. All nylon is under government allocation for military purposes, principally parachutes, airplane tire cord, flak protective devices, glider tow rope, ponchos, mildew-resistant equipment, tapered bristles for Navy paintbrushes, wire insulation and molded parts for airplane instruments.

HONORARY DINNER FOR JOHN C. OLSEN

A DINNER in honor of John C. Olsen, professor emeritus and formerly head of the department of Chemical Engineering at the Polytechnic Institute of Brooklyn, will be held at the Hotel Bossert, Brooklyn, on April 7. At this occasion a portrait of Dr. Olsen, done by Wilford Seymour Cowrow, class of 1896, will be presented to the Institute by friends and former students of Dr. Olsen in recognition of his many years of teaching service. The dinner is open to all friends of Dr. Olsen and invitations may be obtained by addressing Dr. Donald F. Othmer at Polytechnic Institute.

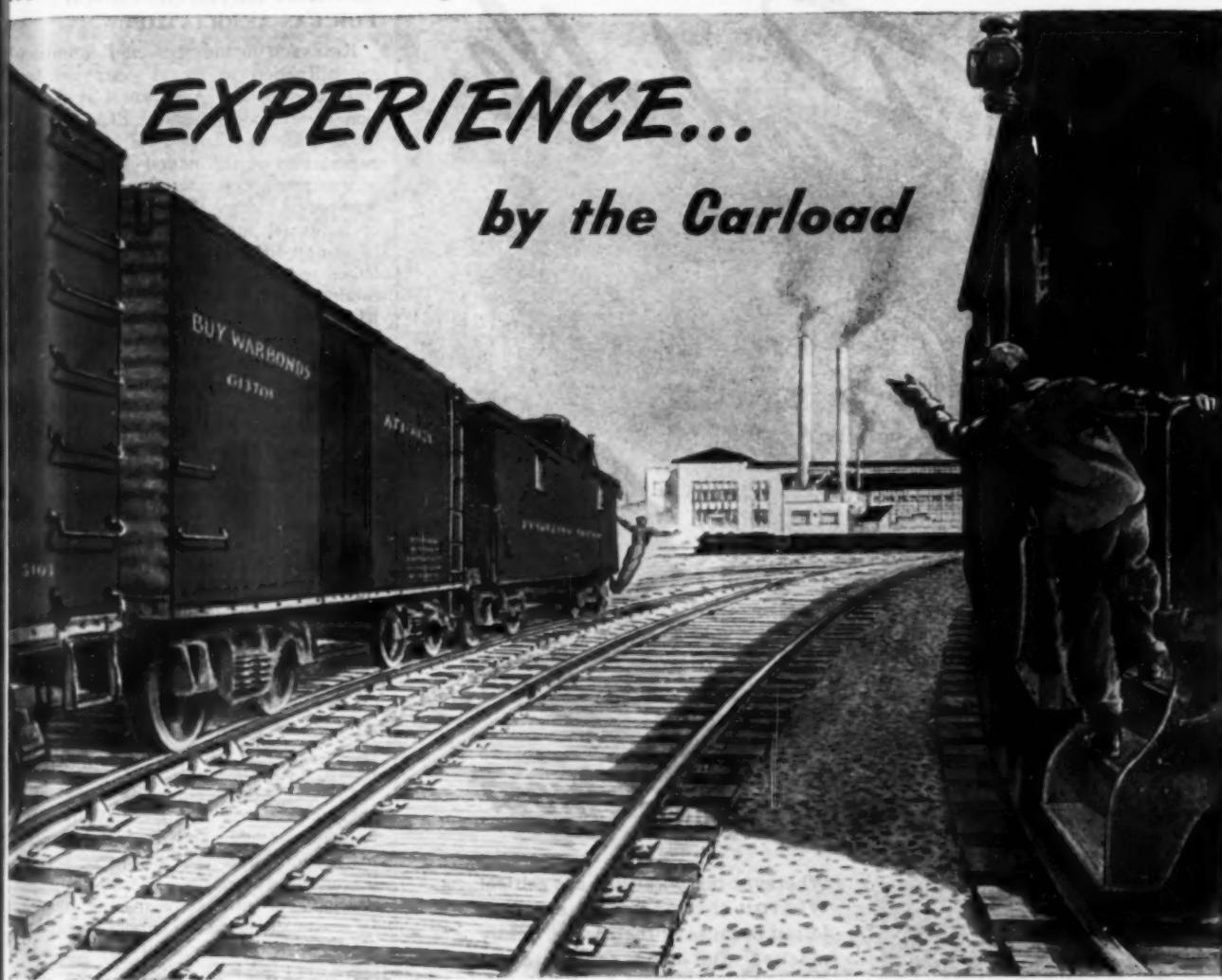
GOODRICH SELECTS SITE FOR CHEMICAL PLANT

REPORTS that the B. F. Goodrich Co. would build a new chemical plant have taken on definite shape through an announcement by W. S. Richardson, general manager of the company's chemical division, that options had been taken on land near Avon Lake, Ohio. The Avon site was selected because it is close to Cleveland and has adequate supplies of water and power. An experimental war chemicals plant will be constructed in the next few months after government approval of the project.

Number 8 of a Series: "Looking at the 5 essential things you never see in anodes!"

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are available in sizes and types for most industrial needs . . . as well as in laboratory models with full scale accuracy within $\frac{1}{2}$ of 1%.

Wherever temperatures are critical WESTON thermometers are preferred because of their large, boldly marked dial-type scales. Even though mounted high above eye level, or on equipment in poorly illuminated areas, the scale is visible, and readable, without inconvenience. Thus readings are made in less time . . . and with far greater accuracy . . . and without the temptation to carelessness that low visibility invites.

The wide-spread adoption of WESTON thermometers throughout the synthetic rubber, oil refining, and other process industries has been due to this readability, plus the records for long-time dependability which these simple all-metal thermometers have established. Literature giving complete specifications on all models gladly furnished on request. Weston Electrical Instrument Corporation, 660 Frelinghuysen Ave., Newark 5, N. J.

WESTON

BELLAMY HEADS RESEARCH FOR GAS ASSOCIATION

RESEARCH in industrial and commercial gas utilization in recent years has been conducted by the American Gas Association on a moderate scale. Plans are now being made to enlarge greatly the work in anticipation of the period of reconversion of war production plants and of the post-war period, when the correct application of industrial and commercial gas will be of utmost importance. To direct this enlarged research work, J. French Robinson, president of American Gas Association, has appointed Charles R. Bellamy to the chairmanship of the committee on industrial gas research. Mr. Bellamy is chief engineer, gas department, Columbia Gas and Electric Corp. and vice president of the Columbia Engineering Corp. He is a graduate of Lafayette College in chemical engineering and is a member of the American Institute of Chemical Engineers.

RUBBER INTERESTS ACQUIRE VULCANIZATION PATENTS

BASIC patents covering electronic vulcanization of rubber and other materials have been purchased by The B. F. Goodrich Co. and The Firestone Tire & Rubber Co. The patents were originally granted on discoveries made by R. A. Dufour and H. A. Leduc of France, and by E. E. W. Kassner of Switzerland.

In making the announcement the rubber companies stated that the patents would be made available both to the rubber and plastics industries on a reasonable basis believing that this policy will speed electronic development ultimately making available to consumers improved rubber and plastics products at lower costs. It was stated that rapid steps had been made in creating more uniform and higher quality products with great savings in time through electronic vulcanization.

WOOD TANK MANUFACTURERS FORM INSTITUTE

AFTER several preliminary meetings attended by principals of the majority of the manufacturers in the industry, producers of wood tanks have incorporated an organization and called it the National Wood Tank Institute. Samuel Emmons Chaner, formerly field engineer for the California Redwood Association of California, was appointed executive director and offices have been opened in the Monadnock Bldg., Chicago. The engineers of the Institute will serve as consultants to the trade and allied industries as well as to the members of the new organization.

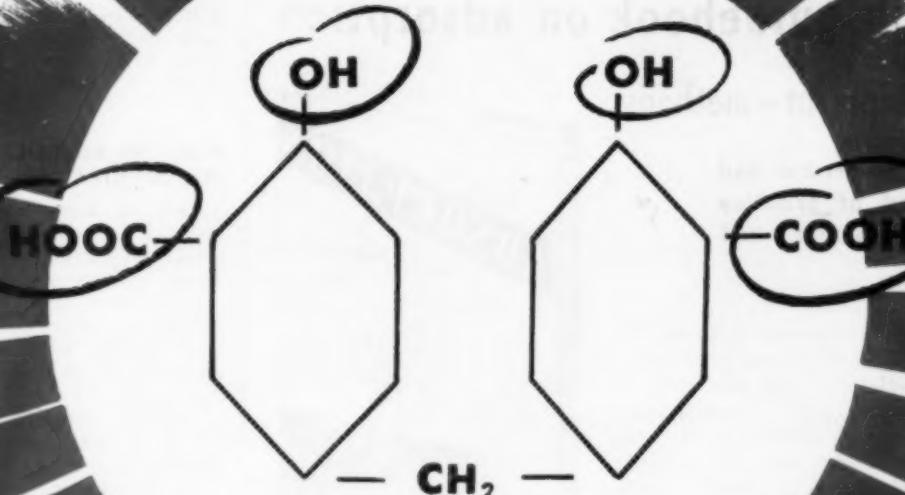
INTERNATIONAL MINERALS ADDS ACIDULATING PLANT

AN addition of a \$125,000 acidulating plant to its fertilizer works at Chicago Heights, Ill., has been reported by Louis Ware, president of International Minerals & Chemical Corp. The addition, which went into operation around the middle of March, is expected to increase the superphosphate capacity of the plant by 25 to

M. D.
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By



A NEW DIBASIC ACID

... M.D.A. (Methylene Disalicylic Acid)

M. D. A. is a technical grade of methylene disalicylic acid of special interest to chemists working with resins and drying oils for use in the manufacture of paints, varnishes, protective coatings, printing inks, linoleum and many other products. It consists of a mixture of isomers, principally the para-para form. In addition other isomers as well as small amounts of low molecular weight polymers are probably present.

As indicated in the formula above, an interesting and significant property of methylene disalicylic acid (dihydroxydiphenylmethane dicarboxylic acid) is the combination of the reactive carboxylic acid groups with the phenolic groups in the same molecule.

By such a combination the versatility of the alkyd

type resins may be combined with the chemical resistance of the phenolic types.

This has been shown by experiments in the Heyden laboratories. For example, it has been found that alkyd resins made with M. D. A. and a pentaerythritol alcohol overcome the poor alkali resistance of ordinary alkyds. When varnishes are formulated with these new alkyd resins the resulting products are improved rapid-drying protective coatings.

M. D. A. may be used with rosin and pentaerythritol alcohols to produce modified phenolic resins which can be cooked into varnishes by the usual methods to produce fast-drying paints and varnishes of improved chemical resistance.

Samples and further information available upon request.



HEYDEN Chemical Corporation

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A thorough guidebook on adsorption materials—equipment—methods

industrial treatment and background of practice for the engineer and operator

A detailed, authoritative treatment of adsorption from the viewpoint of industrial practice, presenting the facts about adsorbents and their applications that will be of value to the designing engineer and plant operator. Illustrated by material and data drawn from leading industrial practice, explains fully the fundamentals of adsorption as a unit operation, the manufacture, properties, and uses of the various classes of adsorbents, and the methods, special factors, etc., of using adsorption in such applications as the refining processes, solvent recovery, odor removal, air conditioning, etc.

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ADSORPTION

By C. L. Mantell

Consulting Chemical Engineer

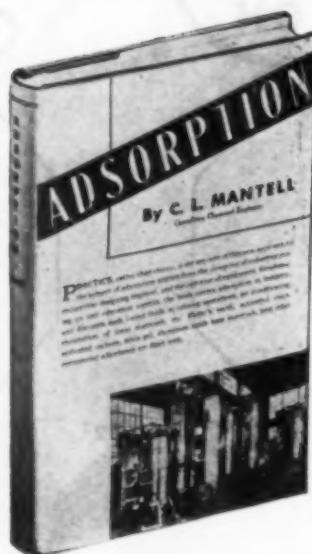
386 pages, 5 1/8 x 8 1/4,
149 illustrations, 78 tables, \$4.50

This book fully covers the subject of adsorption, emphasizing its unit operation aspects, and covering widely varying fields, such as refining operations, air conditioning, elimination of toxic materials, etc. The commercial adsorbents, such as fuller's earth, activated clays, activated carbons, silica gel, and aluminum oxide base materials, are dealt with, with information on their manufacture, properties, and uses.

A good deal of material not available elsewhere in book form is included on materials such as adsorptive carbon, base exchange materials, ion exchangers, gas hydrates, dehydration of natural gas lines, aluminum base adsorbents.

CONTENTS

1. The Unit Operation of Adsorption
2. Theories of Adsorption
3. Fuller's Earth and Activated Clays
4. Aluminum Oxide Base Materials
5. Bone Char and Related Materials
6. Decolorizing Carbons, Water-treatment Carbon
7. Metal- and Medicinal-adsorbent Chars
8. Gas-adsorbent Carbons
9. Silica Gel
10. Magnesia and Hydrous Oxides
11. Solvent Recovery and Adsorption from Gases
12. Odor Removal
13. Gas Masks
14. Gas Hydrates
15. Dehydration of Air and Gases
16. Ion Exchangers
17. Chromatographic Adsorption Analysis
18. Inspection, Specification, and Testing of Adsorbents
- Appendix. Fundamental Laws, Energy Relations, Conversion Factors



Look up in this book:

- adsorption rates and equilibria
- factors affecting porosity of adsorbents
- advantages of adsorbents for processing of liquids
- advantages of adsorbents for percolation and contact filtration
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- clays in the decolorization of mineral oils
- typical flow sheet of contact filter plant
- manufacture of acid-treated clays
- use of bone char in sugar refining
- obtaining drypton and xenon from air with cooled charcoal
- measuring adsorption efficiency
- recovery of volatile solvents in rayon manufacture and rotogravure printing
- recovery of gasoline from natural gas

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Company

Position

30 percent over the former tonnage. M-Ware also announced that the corporation plans to build two additional fertilizer plants in the midwest when materials are available.

PHILLIPS PETROLEUM OPENS POLYMERIZATION PLANT

PHILLIPS PETROLEUM CO. has announced the completion of an extensive rubber polymerization plant at Phillips, Texas. The new unit (see picture on front cover of this issue) constitutes another addition to centralized research department facilities, which were shown to the public during an Open House which was held on January 5.

Experimental studies related to the production of better quality polymers are now being conducted by a staff of chemists and chemical engineers, under the supervision of J. E. Troyan, who was recently associated with the Process Development Section of the Office of Rubber Director.

The pilot plant contains diversified equipment for distillation and purification of monomers, polymerizers, a coagulation unit, and filtration and drying equipment. Here it will be possible to produce sufficient rubber for full-scale processing and tire tests. Auxiliary refrigeration equipment, a small scale polymerization unit, and raw material storage space are located in an adjacent one-story building.

AVAILABLE MANUFACTURING CAPACITY TO BE REPORTED

THE War Production Board Production Readjustment Committee announced on March 2 that in cooperation with the military services and other procurement agencies it will issue reports on available manufacturing capacity in the United States twice each month.

These reports will be compiled for the purpose of assuring that maximum use for war production is made of all available plants in the country. The military services have agreed to check the list of open capacity plants prior to the placement of any direct war contracts, in order that production schedules may be speeded up. At the same time, WPB is urging all persons seeking to place subcontracts under military contracts to get in touch with their nearest local WPB office for information as to facilities they might use. Information gathered in the semi-monthly reports will be furnished to all local WPB offices.

ENTRIES INVITED FOR HYATT AWARD

ENTRIES for the 1944 John Wesley Hyatt award, the nation's most distinguished award for achievement in the plastics industry, have been invited by William T. Cruse, secretary of the award committee. Names of men and women to be considered must reach the committee's headquarters at 295 Madison Ave., New York, not later than March 26.

The award, consisting of a gold medal and a cash gift of \$1,000 sponsored annually by Hercules Powder Co., is presented to the individual who, in the opinion of the

(Books sent on approval in U. S. only)



OWI Photo by Palmer in an Allegheny Ludlum plant.

To this Flywheel, Many a Bomber OWES ITS OWN ABILITY TO FLY

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WITHOUT special alloy steels, no modern bomber would fly . . . in fact, there are more of these materials in the big planes than any other single ingredient, a fact not so commonly understood.

Many of these special steels—electrical, corrosion and heat-resisting, valve and nitriding—first passed over the big breakdown mills in Allegheny Ludlum plants. Even more particularly, many of them were developments of our own research, and all of them are raw materials of the greatest portent for the future.

Special steels have eloquently demonstrated their ability to do for

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These six (6—count them!) EVERLASTING valves on the acid lines of this chemical plant, are just a few of the many EVERLASTING valves which have faithfully served there for many years. Valves which can stand up under the acid test of such heavy duty—can readily enough serve dependably on YOUR operations!

This chemical plant requires valves which open to full-pipe-size straight-through flow—or close to a drop-tight seal—instantly. They require valves which can withstand the erosive and corrosive ordeal of the various acids and other chemical fluids that are alternately flowed through these process pipe lines . . . "The Acid Test"—literally! That's why their engineers specified these EVERLASTING valves many years ago . . . and still have no regrets!

Because of their 24-hour operation, this chemical plant does not use valves which would require the usual periodic maintenance, necessitating production shut-downs. That's why you see these EVERLASTING valves throughout the plant! Trouble-free . . . many not maintained in years of this grueling service . . . dependably serving a long life sentence at hard labor! If that's the kind of valves you need—then always specify EVERLASTING Valves!

If you have a valve problem, please write and give us the details. Our valve engineering experience of over 35 years is at your service—without obligation.

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judges, has made an outstanding contribution of wide importance to the plastics industry during the preceding year.

The award committee consists of Richard F. Bach, Dean of Education, The Metropolitan Museum of Art; Dr. Lyman J. Briggs, director, National Bureau of Standards; Dr. Karl T. Compton, president, Massachusetts Institute of Technology; Watson Davis, director, Science Service; Dr. Carl S. Marvel, president, American Chemical Society; George K. Scribner, president, Society of the Plastics Industry; Dr. Stuart D. Douglas, head of research, Carbide and Carbon Chemicals Corp., and the secretary, Mr. Cruse.

AMERICAN CYANAMID BUYS LARGE PLANT SITE

PURCHASE of approximately 800 acres of land along the Ohio River near St. Marys, W. Va., was announced by American Cyanamid Co. last month. Company officials said this purchase was made for its Calco Chemical Division whose principal plant is now located at Bound Brook, N. J. The site was selected because it will provide a location for the development of new products whose basic raw materials are available in the Ohio Valley section. Because of wartime restrictions on building, the company has placed no definite time for developing the property but the new project is expected to play an important part in Calco's postwar program.

LEACHING PLANT BUILT HIGH IN ANDES

THE HIGHEST leaching plant in the world, clinging to the Andes Mountains in Peru nearly three miles above sea level, has been completed for the Vanadium Corp. of America by The Rust Engineering Co. of Pittsburgh. The plant is served by a diesel power plant, pump house, boiler house and 150 dwelling units for native labor. The engineering firm also has designed and built a crushing plant and drier at Vanadium's Minaragra Mine which is 15,600 ft. above sea level. Almost the entire plant, equipment and auxiliary structures had to be shipped from the United States.

NEW SULPHATE PULP MILL FOR BRITISH COLUMBIA

PLANS for the establishment of a new sulphate pulp mill at Port Alberni, British Columbia, have advanced a further stage. Bloedel, Stewart & Welch Ltd., one of the major local timber concerns, were planning the erection of such a mill alongside their large sawmill at Port Alberni, at the outbreak of the war. Since that time, while no major move was made towards building of the mill, plans were quietly completed. It is now announced that contingent on the approval by the Provincial Government of an assessment agreement between the City Council of Port Alberni and the company that the company will erect a plant there with an annual production of 50,000 tons of sulphate pulp.



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Aluminum reusable drum weighs only
21 pounds. What do yours weigh...
and cost you to ship?

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100-octane gasoline is being flown over the "hump" to China in aluminum drums . . . built by Alcoa. 31 pounds lighter than ordinary returnable drums, they permit carrying hundreds of thousands of additional gallons of gasoline per month to the 14th and 20th Air Forces.

Developed by the USAAF and Alcoa engineers specially for the China-Burma-India theater, these lightweight drums have interesting postwar possibilities for shippers who use similar containers. Their ability to withstand rough handling has been proved by thorough tests at Wright Field and by actual use. Furthermore, they require no painting; will not rust.

But lower shipping costs and easier handling are the advantages that interest shippers most in these drums. Those same advantages can be had in barrels, carboys, and other bulk containers when built of Alcoa Aluminum. Worth looking into, don't you think? Write ALUMINUM COMPANY OF AMERICA, 2151 Gulf Building, Pittsburgh 19, Pennsylvania.

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metal itself is "insulated" from corrosive atmospheres by the silicate in which it is immersed. And the silicate glass keeps in usable condition for long periods. The low iron and alumina content of "SS" Brand gives high transparency to infra-red rays.

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Interior of furnace unit showing reaction tube before embedding in the "SS" Silicate



PQ SILICATES OF SODA

WORKS: Anderson, Ind. • Baltimore, Md. • Chester, Pa. • Cartersville, Ga.
Baltimore, Md. • Newark, Del. • Newark, N.J. • St. Louis, Mo. • Wichita, Kans.

LAS VEGAS PLANT TO MAKE POTASSIUM PERCHLORATE

PREPARING to produce potassium perchlorate, Western Electrochemical Co., Los Angeles, will convert a unit of the Basic Magnesium property at Las Vegas, Nev., into a production plant at the request of WPB, acting on orders from the Defense Plant Corp. The Los Angeles company was formed in 1941 to do specific wartime work. It is headed by Kenneth Walsh who brought to the Pacific Coast as technical director of his company, Joseph C. Schumacher, well known for his work in chemical production. (See *Chem. & Met.*, Dec. 1944, pp. 108-109, 130-138.)

Mr. Schumacher, who aided in the development of the process utilized by Western Electrochemical Co. in the production of potassium perchlorate, formerly was with Carus Chemical Co. of La Salle, Ill., which still uses the process he worked out for the manufacture of hydroquinone. He will have charge of the conversion of the Basic Magnesium plant.

EXPANSION PROGRAM FOR TEXTILE SCHOOL

THE Institute of Textile Technology, a graduate school, chartered in Virginia, announces the approval by its board of trustees of a new building program. The present office and laboratory activities are housed in the 16-room residence and the six-car garage of the permanent home to which the Institute has just moved. The location is near Farmington, west of Charlottesville, Va. The tentative building program contemplates erection of laboratory buildings in two rows facing each other across the formal gardens behind the residence, which will then be the administration building.

An applications building, equipped with modern textile machinery, will be erected across the lower end of the formal gardens. The two rows of laboratory buildings will be connected with the administration building at one end, and with the applications building at the other end, by a covered colonnade.

The Institute is a not-for-profit corporation, owned by its members and governed by a board of trustees selected by the members. Its board consists of executives prominent in the textile industry, and its field of service now extends from Waterville, Me., to Birmingham, Ala.

SULPHUR EXPORT CORP. UNDER F.T.C. INVESTIGATION

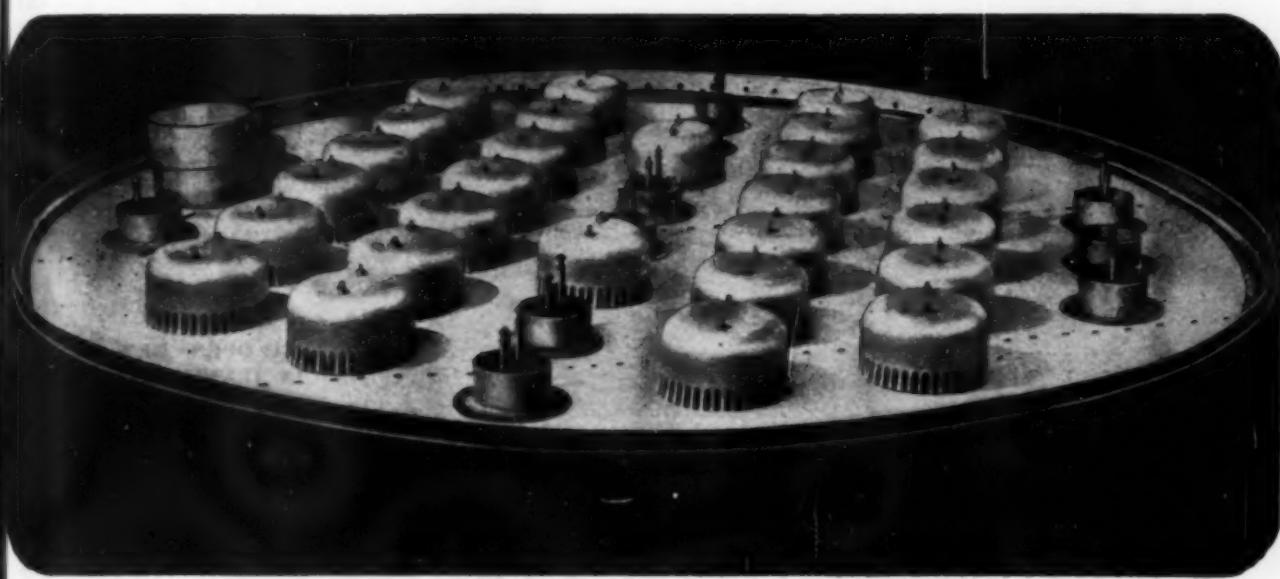
THE Federal Trade Commission has ordered an investigation of Sulphur Export Corp., New York, to determine whether it has engaged in practices and entered into agreements in violation of the Export Trade Act. The date of the opening of hearings will be announced later.

Notice of the investigation was served upon the corporation and the following stockholders, officers and directors: Clarence A. Snider, president; S. Magnus Swenson, vice president; James T. Kilbreth, secretary and counsel; Charles W. Kemmler, Jr., treasurer; and Walter H. Aldridge, Langborne M. Williams, Jr.

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This time-proved stainless steel offers many advantages. It resists the attack of rust and corrosion. It resists most acids, compounds and gases, hot or cold. It will not contaminate most chemical solutions. It is easy to clean. It

is tough and strong—has good creep strength. It resists scaling at high temperatures, too, and thus is well suited for furnace parts.

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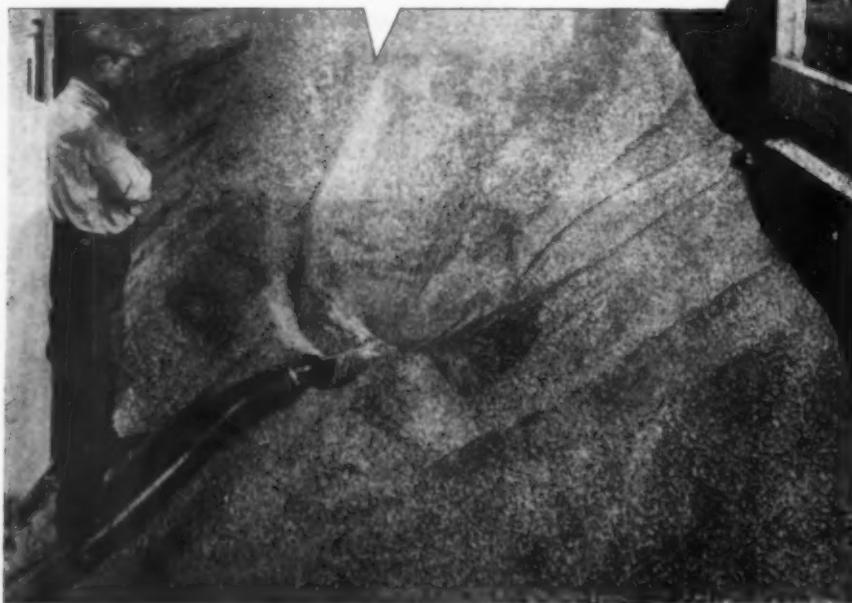
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DU PONT INCREASES NUMBER OF FELLOWSHIPS

THIRTY-FIVE postgraduate fellowships at 29 universities are offered by E. I. du Pont de Nemours & Co. for the academic year of 1945-46. This is an increase of 11 over previous years and for the first time includes two fellowships in physics, reflecting the increasing need for physicists in the chemical industry. Five of the fellowships are in chemical engineering and 21 in chemistry.

Two changes have been made in the fellowship plan this year. First, in order to equalize the value of fellowships among the various universities, where tuition rates differ, the company is paying the tuition in addition to the stipend. And second, the amount of the stipend has been increased from \$750 to \$1,000. Women as well as men are eligible, and selection of the recipients and the subjects of their researches is left to the universities. Holders of these fellowships are not restricted in any way in their choice of position when the fellowship expires.

MONSANTO OPENS NEW CWS PLANT IN TENNESSEE

FULL-SCALE production by Monsanto Chemical Co. has started at the Duck River Plant, a new government-owned plant which Monsanto operates for Chemical Warfare Service at Monsanto, Tenn. Costing more than \$2,500,000, the new plant adjoins and utilizes byproducts of Monsanto's elemental phosphorus plant, which produces more than 10 times America's World War I output of elemental phosphorus.

NEW CRACKING PLANT IN FULL OPERATION

THE HUGE catalytic cracking plant which was put into operation by Tide Water Associated Oil Co. at Avon, Calif., in mid February, is now producing 60 railroad tank cars of 100 octane aviation gasoline daily. The multi-million dollar plant, reportedly the largest single unit of its kind in the country, has increased production at Avon 15 times over the refinery's pre-war capacity for 100 octane fuel.

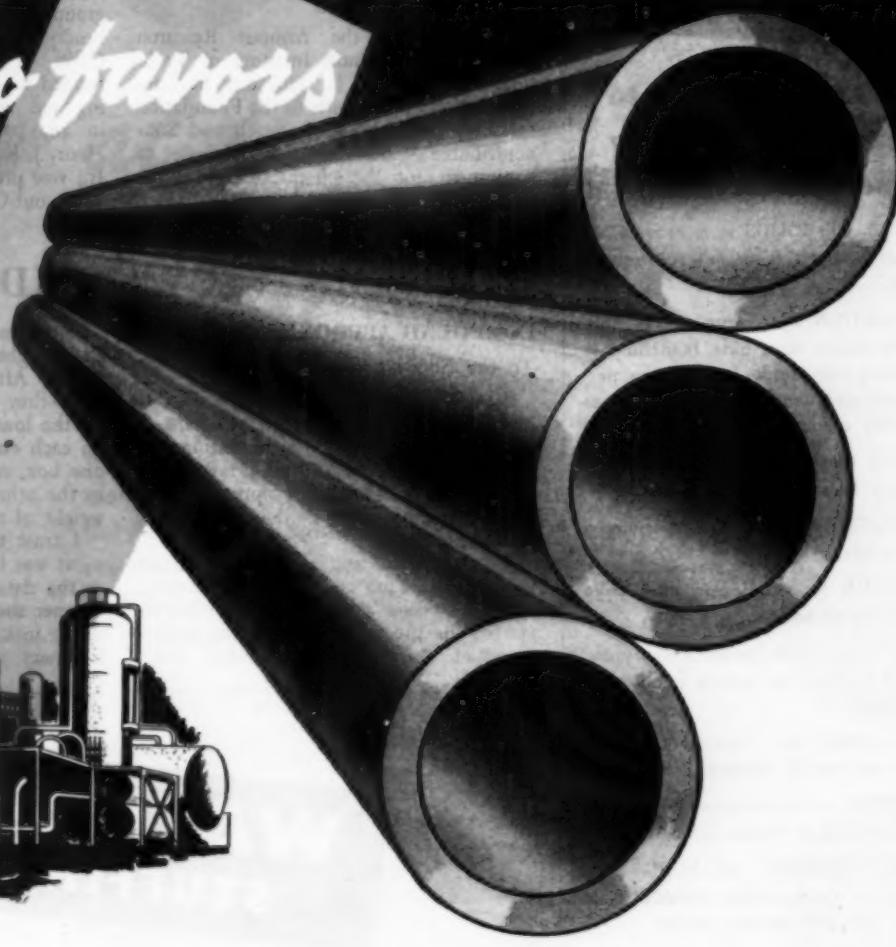
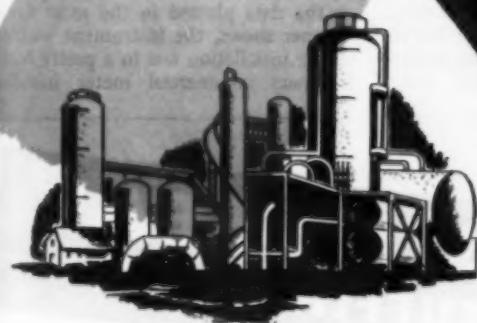
Built entirely with company funds, the plant is expected to operate in the postwar period after its high-power output is geared to commercial demands.

Towering 200 ft. into the air, the catalytic cracking plant produces gasoline components through one cracking step, the reaction taking place at about 950 deg. F. in a 300,000-gal. vessel where oil is brought in contact with hot catalyst. About 40 tons of catalyst circulates through the cracker each minute.

The gas plant of the catalytic unit includes a series of fractionating columns ranging in height to 85 ft. and five gas compressors totaling 400 h.p. Handling the recovery of liquid products from gases

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Timken Seamless Tubes are a rugged dependable product that ask no favors. Even when subjected to the severest conditions of extreme temperature, high pressure and severe corrosion they provide long, reliable service.

To meet the many different conditions of today's refineries, Timken Seamless Tubes are available in carbon, intermediate alloy and Stainless Steel grades. Many special analyses have been developed through research on high temperature

steels carried on for the past 17 years by The Timken Roller Bearing Company.

If you want greater production through less down time and maximum tube life per dollar invested, specify Timken Seamless Steel Tubes. If you wish, a member of our technical organization will be glad to help you select the tube that meets your particular problem. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

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SEAMLESS STEEL TUBES

Which of These Must Your Filter Do?

Here Are 9 Separate Operations You May Expect of a Filter

- 1 RECOVERY OF SOLIDS in a reasonable degree of firmness to permit subsequent handling.
- 2 CLARIFICATION by means of any suitable filter media, filter aids, bleaching or decolorizing compounds, to produce perfect clarity and desired color, regardless of viscosity of material.
- 3 WASHING the filter cake—partially or thoroughly free of soluble contents.
- 4 BACKWASHING to clear filter of undesirable solids.
- 5 EXTRACTION of volatiles in filter cake by steaming or heating.
- 6 DRYING of filter cake in the filter by air, steam or heating to reduce subsequent drying time.
- 7 REDISSOLVING filter cake by fresh solvent or melting by heating in the filter.
- 8 THICKENING or decantation in filter by partial removal of liquid continuously.
- 9 COUNTER CURRENT LEACHING intermittently or continuously, especially on slurries with slow settling solids.



THIS NEW
BOOK
TELLS HOW
YOU CAN

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ALL WITH A
SHRIVER
FILTER PRESS

T. SHRIVER & COMPANY, Inc.
802 Hamilton St. Harrison, N. J.

produced in the cracking process, it separates them into component parts.

Said to be the first commercial plant of its type constructed, a pentane isomerization plant at Avon synthetically produces isopentane used in the blending of aviation gasoline.

ARMOUR RESEARCH GETS ADDITIONAL GIFTS

DIRECTOR of the Armour Research Foundation of Illinois Institute of Technology, Dr. Jesse E. Hobson, has announced two recent gifts to the Foundation totalling \$10,500. E. J. Brach and Sons contributed funds for the purchase of equipment for the chemical engineering section and technical books for the library.

A donation from National Acoustic Products will be used to buy a frequency recording meter, an instrument for measuring the frequency of alternating currents.

HENRY J. KAISER HEADS NEW ENGINEERING ORGANIZATION

ENGINEERS long associated with Henry J. Kaiser have been organized as a permanent group known as Kaiser Engineers with headquarters in the Kaiser Bldg., Oakland Calif. The new group includes men trained in all the major fields of engineering and will undertake engineering work in any part of the world. Officers are Henry J. Kaiser, president; E. E. Trefethen, Jr., vice president; T. M. Price, vice president; and George Havas, vice president.

READERS' VIEWS AND COMMENTS

COMPOUND APPROXIMATION

To the Editor of Chem. & Met.:

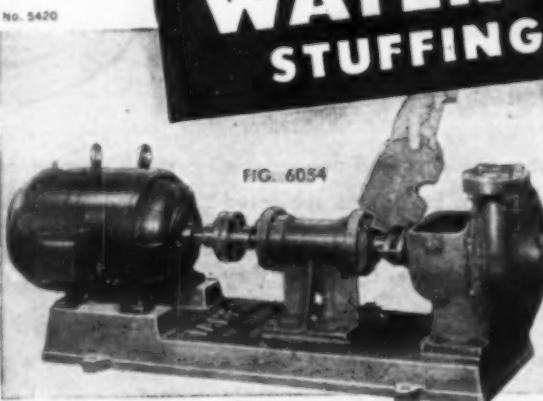
Sir:—My attention has been called to p. 118 of the November issue of Chem. & Met. While that story is interesting (see attached plot of data) I think it savors a bit too much of compound approximation. When something is to be done wrong why not be thorough?

It seems there was a farmer whose son joined a Pig Club and studied pig raising. Then his father gave him a piglet and he started the processing. As in any process operation, measurement problems arose.

The pig had to be weighed each week and the weight recorded, but they had no scales. After much talk—a conference in fact—they proceeded to balance a plank on the lower slat of the fence, nail a box on each end of the plank, put the pig in one box, and counterpoise it with stones in the other box. Then they guessed the weight of the stones!

I trust the transfer of the flow instrument was to the instrument shop, because as the data plotted in the most favorable manner shows, the instrument and/or the orifice installation was in a pretty bad way. Ordinary commercial meter installation

WATER-SEAL STUFFING BOX



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and
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Taber single suction Centrifugal Pump, equipped with a drip chamber and cover for handling chemical solutions. When used for vacuum service on evaporators the drip chamber is filled with water. This prevents air from entering through packing. The stuffing box is thereby water-sealed.

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HEAD FOR HELPFUL TABER

BULLETIN CL-339

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ESTABLISHED 1859

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Whenever a steam fitter breaks a line and inserts a Sarco strainer, a steam trap or a temperature control, he makes a permanent contribution to the efficiency of that part of the plant. Increased output of the steam equipment, dependable operation, increased quality of the product and the fuel savings that invariably follow will go on for years as a result of an hour's work.

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Steam helped the war effort, but steam economy will be necessary for industrial survival in peace. All over the plant, you will find spots where the man with the wrench can easily insert inexpensive Sarco Steam Savers that were overlooked or not available at the time.

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Easy does it. Call in the Sarco representative for a re-check on your steam engineering. Order a supply of the traps you need. Then, during shut-downs or long week-ends, the man with the wrench can slip them in. Before you realize it, your plant will be on the way to post-war competitive efficiency.

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Saves
Steam



SARCO STRAINER

SARCO 87-S THERMOTON

Strainer



Controlling cooling coil



Blender on showers

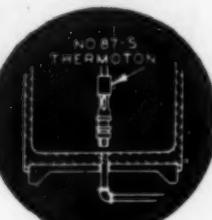
SARCO MB BLENDER

STORATAN



SARCO TR-40 REGULATOR

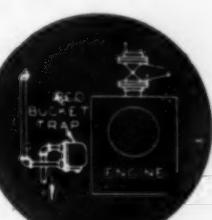
Controlling solvent still



Heating water with 87-S



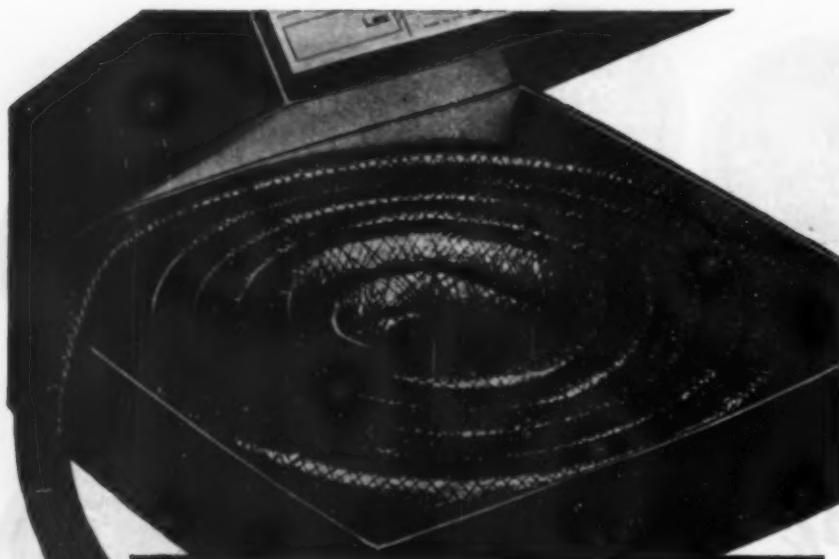
FT trap on cooker



Bucket trap on engine supply



TR-22 control on Kettle



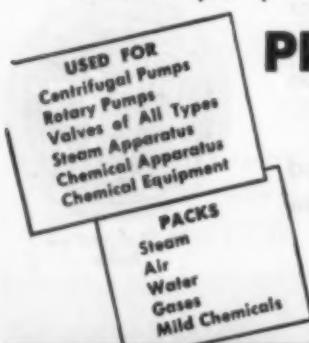
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This Palmetto Packing has ultra-high resistance to friction and heat. It does not dry out or harden—no liquid lubricant to be squeezed out or melted.

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Supplied in square shape, coil form. Order from your local Greene, Tweed distributor, or, if necessary, direct from us.

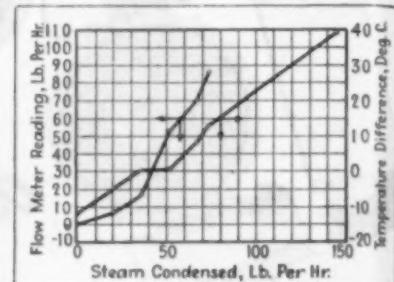
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made in accordance with manufacturer instructions always should be within \pm percent, and much closer measurement is possible with the sharp-edged orifice and flange or vena contracta taps under favorable conditions. It might also be noted that an initial negative temperature dif-



ference from the thermopile, together with a surprisingly large temperature difference, seems to indicate rather large conduction errors somewhere, probably in the thermometer wells. The real temperature difference from expansion through the orifice should be rather small, perhaps 2 deg. F. It could be calculated if orifice ratio and steam condition were known.

E. D. HAIGLER

The Foxboro Co.
Foxboro, Mass.

CHEMIST BLIGHT

To the Editor of Chem. & Met.:

Sir—I inclose a clipping from the Roanoke Times in which a ludicrous error can well be used as an editorial title.

The present military policies may soon give a bad case of chemist blight to the useful chemists of our country.

One of the problems of democracy in our high schools will be insistence upon better instruction and better laboratories for foundation work in mathematics, chemistry and physics.

We need not only the nucleus of research and preliminary universal training but more and better science teaching further down, and by that I do not mean science unified by the egg-beater method.

R. E. BOWMAN

Blacksburg, Va.

Inclosure

NEW YORK—A new method for extracting tannin from the bark of western hemlock trees has been reported....

Present American sources of the useful chemical have been depleted by chemist blight, and there is a large market for domestically-produced tannin....

CORRECTION

IN THE article "Chemical Requirement of the Pulp and Paper Industry" which appeared on p. 114 of our January 1945 issue, there are two typographical errors which should be corrected. In the table "Total United State Production of Pulp," the first column headed Total Sulphate should have been labeled Total Sulphite and the second, Bleached Sulphite, should have been Bleached Sulphite.



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The safe delivery of your products is of paramount importance today. Therefore, you are undoubtedly giving close attention to shipping and storage containers.

If you use cylinders, your search for an exceptionally dependable product will inevitably lead you to Scaife. Over the years we have developed the "know-how," assembled the skilled workmen and installed the modern machinery to make cylinders that meet your most exacting requirements.

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WILLSON No. 5 and 45 Lightweight Respirators with easily replaceable filters protect workers. They remove harmful dusts and mists. Bureau of Mines Approvals for various hazards. Filters tested for low breathing resistance.

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NEWS FROM ABROAD

PLASTICS AND SYNTHETIC FIBERS HAVE PROMINENT PLACE IN BRITISH WAR PLANNING

Special Correspondence

WARTIME secrecy surrounds all activities of the British chemical industry, and company reports and presidential speeches at association meetings have been confined to such non-controversial and general topics as the need for more research, the reform of patent legislation, the urgency of fuel economy, the desirability of larger exports, the importance of good relations with labor, and the necessity of postwar planning. If it comes to details, information is generally withheld. Of the many new products which entered large-scale production last year only two have received adequate publicity: penicillin and the insecticide DDT.

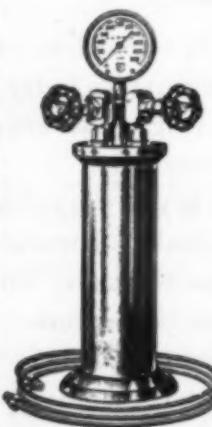
Plans for the production of synthetic rubber provided the only piece of really important news from the sector of industrial chemicals, and here it seems that the first announcement needs some correction. The plant construction dates have not been kept, the British Celanese factory for which a permit was issued in 1943 is still under construction, and there has not yet been any commercial production of general-purpose synthetic rubber. The delay in the erection of this plant is all the more regrettable as it is to fill a seriously felt

gap in England's chemical armor, and successful operation of this factory would no doubt provide a great stimulus for similar expansion in neighboring sectors.

If news of new products is scanty and leading producers are singularly uncommunicative as regards their output plans for the future, there are indications which seem to throw some light on the likely trend of production programs in the first postwar years. Among leading chemical producers the British Celanese, which is responsible for the synthetic rubber plant, has also let it be understood that it entertains ambitious plans with regard to other chemical products. Some months ago it registered a new subsidiary under the general name of Products Development Ltd. Shortly before the close of 1944 it made financial history by announcing, after over twenty years, its first dividend—an event which suggests that its financial position has greatly improved, and also that more finance will be needed in future. Earlier its then chairman, the late Dr. Henry Dreyfus, had proclaimed the company's intention of producing all the raw materials which are important from an economic point of view in the form of intermediate

accurate TESTING APPARATUS for liquefied Petroleum Gases

Vapor Pressure Bomb, Specific-Gravity Bomb, Torsion Balance, Corrosion-Test Bomb, etc., are available for testing liquefied petroleum Gases—C₄ mixtures.



Left: VAPOR PRESSURE BOMB, accurately tests vapor pressures of the various liquefied petroleum gas products up to 2,000 lbs. Test gauge, range 0 to 250 p.s.i. in 1 lb. graduations.

Right: PRESSURE HYDROMETER JAR—for measuring the specific gravity of liquids, which under atmospheric pressure would evaporate into a gaseous form.



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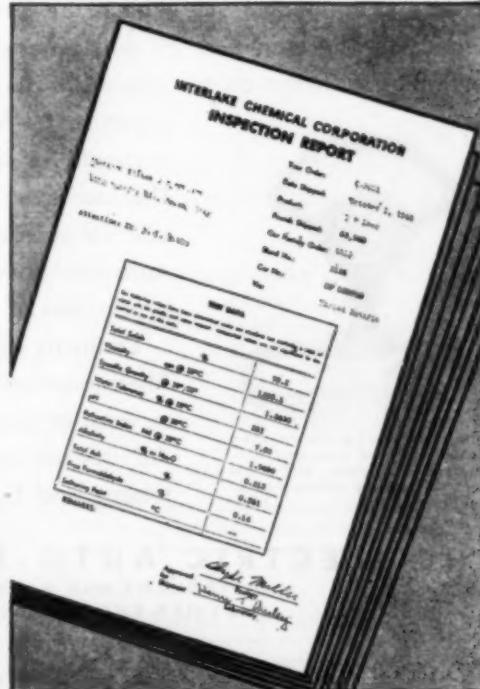
WOOD • PAPER • METAL • GLASS • FIBRE • RUBBER • CELLULOSE • ETC.

IF YOU HAVE A RESIN PROBLEM draw freely upon the wide experience of Interlake. We will gladly work with you on any resin problem, or discuss with you the possible advantage of using resins in any operation or process. Write Interlake Chemical Corporation, Plastics Division*, Dept. 70, Union Commerce Building, Cleveland 14, Ohio.

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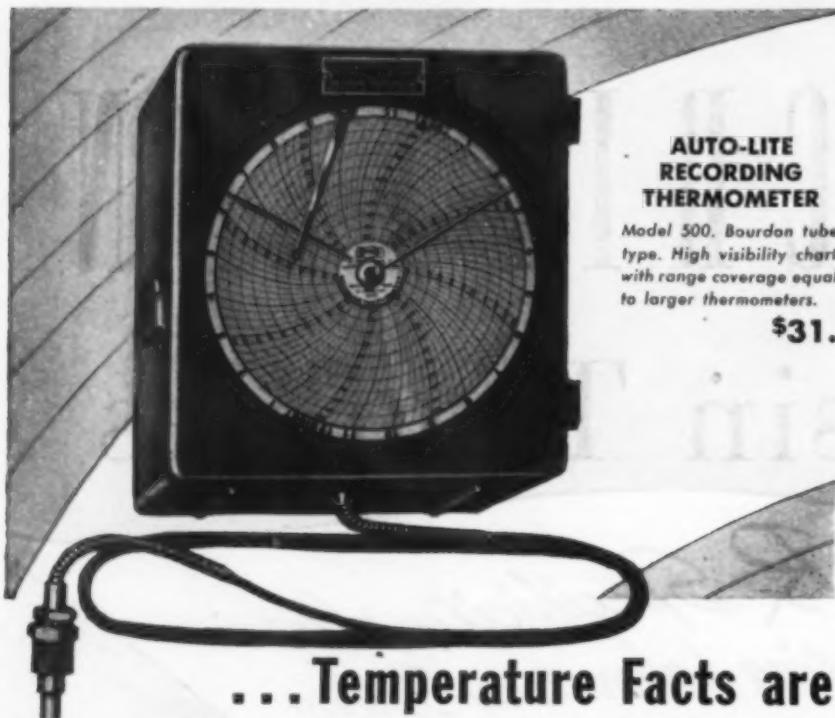
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Degrees of temperature are dollars, working for or against you. To know beyond doubt the ups and downs of operating temperature during a continuous cycle—this is the advantage of having Auto-Lite Recording Thermometers on duty wherever temperature is a factor.

They are always on the job, night and day, busily recording tem-

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Distinctly designed, Auto-Lite Recording Thermometers have no delicate parts liable to wear or to require frequent adjustment. All operating parts, including capillary tubing and bulb, are non-ferrous metals.



Auto-Lite Indicating Thermometer, Model F-1. Used wherever temperature is a factor. With rigid stem or capillary tubing for remote reading. \$20.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
CHRYSLER BUILDING, NEW YORK 17

AUTO-LITE

In addition to a wide range of thermometers and gauges, Auto-Lite specializes in the production of instruments of special design for use as a standard part of manufacturers' equipment. Details on request.

chemicals needed for final textile and other products—surely a very wide and ambitious program.

Britain's other leading rayon producer may also be expected to go in for large-scale expansion after the war, and this expansion is likely to be towards the chemical rather than the textile side. Courtaulds is in a particularly strong financial position as a result of the enforced sale of its U. S. subsidiary, American Viscose, under instructions from the British Treasury before lend-lease was inaugurated. The company is making viscose wrappings and paper in addition to rayon and staple fiber, and shares with Imperial Chemical Industries the financial responsibility for the British production of nylon. Plastics would obviously be the next step leading Courtaulds into the chemical field, and from this there may follow further expansion both laterally towards other chemical manufacturers and vertically towards the raw materials for plastics manufacture.

Plastics are of course an obvious choice for various chemical producers looking for fields of expansion. One of the leading paint manufacturers plans to enter this industry, and one of the biggest cosmetics firms has followed suit. Possibly both these firms think mainly of that corner of the plastics field which borders on their own trade, but the contact between different sectors of the chemical trades which modern chemistry has established is likely to facilitate expansion and overlapping from one sector into another. If, for instance, DDT is included in paints to provide insecticidal protection for wall cover, or if penicillin, as Professor Fleming envisions, is included in toothpaste, shaving cream and even lipsticks, a link is formed between paint and insecticides, pharmaceutical and cosmetics manufacturers which may lead to further cooperation in other spheres.

At present these possibilities can only be mentioned, but soon they may call for special arrangements. The demand in certain fields of industry immediately after the war is indeed likely to be so urgent and yet persistent that it will attract the attention of industrialists who have normally little contact with them. The expected housing shortage, for instance, has already made steel producers plan emergency houses from prefabricated iron and steel, and chemical firms have expressed their willingness to help in the solution of the housing problem by applying their products with suitable adjustments to the anticipated needs.

In sectors of the chemical industry which in any case expect a vast expansion of demand the need for fresh enterprise in outside fields is naturally less urgent. Lewis Berger & Sons, one of the biggest paint producers, has not only developed many wartime products like camouflage paints, dual purpose lacquers for petrol tin water-carriers, anti-gas and gas-detector finishes, insulating varnishes (amongst which Hy-Meg is described unique and needed for electrical equipment in peacetime too), but has reorganized its production methods and hopes that new and improved materials developed for addition to the well established range of branded goods will soon be available for sale at home and abroad. This company apparently intends

NUMBER 1

PROPERTIES WHICH MAY
SUGGEST NEW APPLICATIONS OF
SONNEBORN PETROLATUMS
(Soft Type Micro-Crystalline Waxes)
IN YOUR PROCESSING OR
MANUFACTURING OPERATIONS

Petrolatum is a colloidal system in which liquid hydrocarbons constitute the internal phase while the external phase comprises solid hydrocarbons. In contrast to paraffin wax, which forms crystalline aggregates, petrolatum is amorphous or, more strictly speaking, micro-crystalline.

The range of applications for SONNEBORN Petrolatums is widening constantly. Analysis of the properties and physical characteristics of these soft-type micro-crystalline waxes often results in their adaptation to meet specific requirements in many industrial processing and manufacturing operations.

SONNEBORN Petrolatums are readily available in three types—FONOLINE (soft), PROTOPET (medium soft), and PERFECTA (medium soft with high melting point)—refined in a range of colors to suit various industrial purposes. Special types can be made to meet individual specifications.

Typical properties suggesting many actual or potential applications are listed in the accompanying panel. Other properties will be presented in a subsequent issue. Meanwhile, we shall welcome the opportunity to discuss specific problems with you.

★ ★ ★

This is the first in a series of bulletins focusing industry's attention on the possibilities of SONNEBORN Petrolatums for various processing or manufacturing operations. The next will appear in an early issue of this publication.

★ ★ ★

Please direct inquiries on specific problems to
DEPARTMENT OF INDUSTRIAL RESEARCH

L. SONNEBORN SONS, INC.

Refiners of Petroleum

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**PARTIAL LIST OF PROPERTIES*
OF SONNEBORN PETROLATUMS**

- Freedom from color
- Plasticizing, lubricating, penetrating and softening properties
- Rich in emollient properties
- Controlled consistency
- Render fibrous materials proof against moisture and greases
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- Absence of gumminess or stickiness
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- Non-contaminating to food products
- Render surfaces repellent to adhesive substances

*Properties listed are representative of Sonneborn Petrolatums in general, but this does not necessarily mean that all of these properties exist in any one grade.

RANGE OF PHYSICAL CHARACTERISTICS

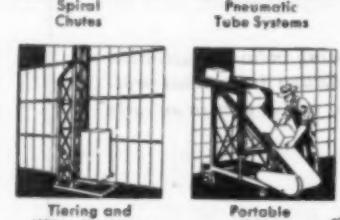
Saybolt Melting Point: 105°F.—130°F.
A.S.T.M. Melting Point: 110°F.—137°F.
A.S.T.M. Consistency: 160—240
Saybolt Viscosity: 45—75 @ 210°F.
Flash Point: 360°F.—430°F.
Specific Gravity: 0.840—0.870 @ 60°F.
Color: Amber to White.



CONVEYORS do more than carry in a horizontal plane. Standard Push-bar Conveyors carry and move packages and containers up a slope or incline at 30, 45, or 60 degree angles; vertical lift conveyors carry commodities straight up and down to the height of several floors. These conveyors that lift and lower can be used individually or combined with a conveyor system to provide uninterrupted flow of commodities between floors.

Push-bar conveyors and vertical lift conveyors are part of Standard Conveyor's wide variety of equipment to cut handling and production costs — power and gravity conveyors in belt, roller, chain, and slat types; spiral chutes, tiering machines, portable pilers, pneumatic tube systems.

Standard Conveyor has been headquarters for conveyors for more than 40 years; we are qualified by long experience to recommend and build efficient equipment for any given installation. Write for catalog CM-35, "Conveyors by Standard" — a profusely illustrated reference book that will prove very useful to you.



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to stay within its old field, and this may be symptomatic for the paint industry in general; but since paints have in the past few years taken on so many new functions beside the old ones of structural protection and adornment, this in itself constitutes a considerable measure of expansion.

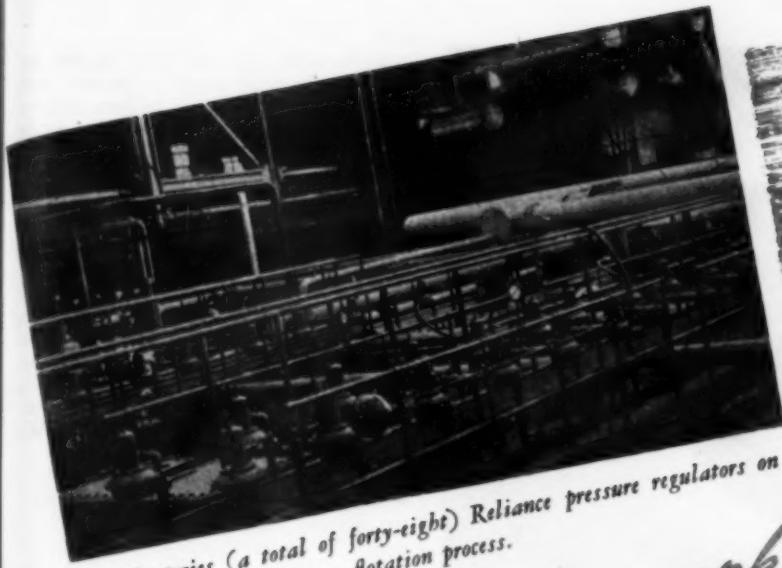
As an illustration of developments at the other end of the chemical industry, the production of raw materials involving a byproduct output of chemical commodities, the case of the Imperial Smelting Corp. may be quoted. This company carried out a fair measure of vertical expansion before the war when, starting from the smelting of zinc, it engaged in the manufacture of zinc paints, sulphuric acid, superphosphates, compound fertilizers, and other byproducts. During the past year the company has been fully employed in the production of "commodities essential to the war effort," but now, to make provision for the future, the smelting works director has been appointed director-general of a research organization which is being established in cooperation with the company's Australian zinc mining associates. It is hoped that specialized research will open up new peacetime outlets for zinc products.

SYNTHETIC FIBERS

Characteristically, synthetic fibers, paints and plastics are also a favorite field of expansion for producers of industrial chemicals. Imperial Chemical Industries has released particulars of a new synthetic fiber which, it is stated, was ready for commercial development when war broke out. "Ardil" was developed at the I.C.I. works at Ardeer, is wool-like, non-shrinking, and moth-proof. It is described as a protein fiber, the protein being extracted from peanuts with dilute alkali, precipitated, and converted into a spinning solution, which is extruded into a coagulating bath to form fine filaments which can be cut into any required length. All-Ardil fabrics have been made, but best use of the new fiber is likely to be in combination with wool for worsteds, woolens, tweeds and knitted fabrics. It is claimed that fabrics containing 50 percent of Ardil are scarcely distinguishable from 100 percent wool, and Ardil is expected to be cheaper than wool. When mixed with cotton or rayon, Ardil changes the character of the final fabric, adding warmth, fullness of handle, resilience, and crease resistance.

From the British point of view the use of peanuts as a raw material is most valuable since large quantities can be obtained from British West Africa, while other sources of protein for fiber production (like soybeans) are not so easily available in British territories. Extraction starts from the residual meal left after the low-temperature removal of the groundnut oil from the decorticated nuts; the meal left after extraction of the protein, with 2 percent nitrogen, can still be used as cattle feed.

The vast advances in the production of fibers and plastics of which the mentioned product is an example cannot but result in important changes in other chemical industries. The rayon producers have already pointed out that they require more specialized information about offered dye



Four batteries (a total of forty-eight) Reliance pressure regulators on flotation process.

All-AMERICAN teamwork of measurement and control in BUTADIENE making...

THE PRESSING importance of butadiene for synthetic rubber production imposes a critical responsibility upon accuracy and ruggedness in measurement and control.

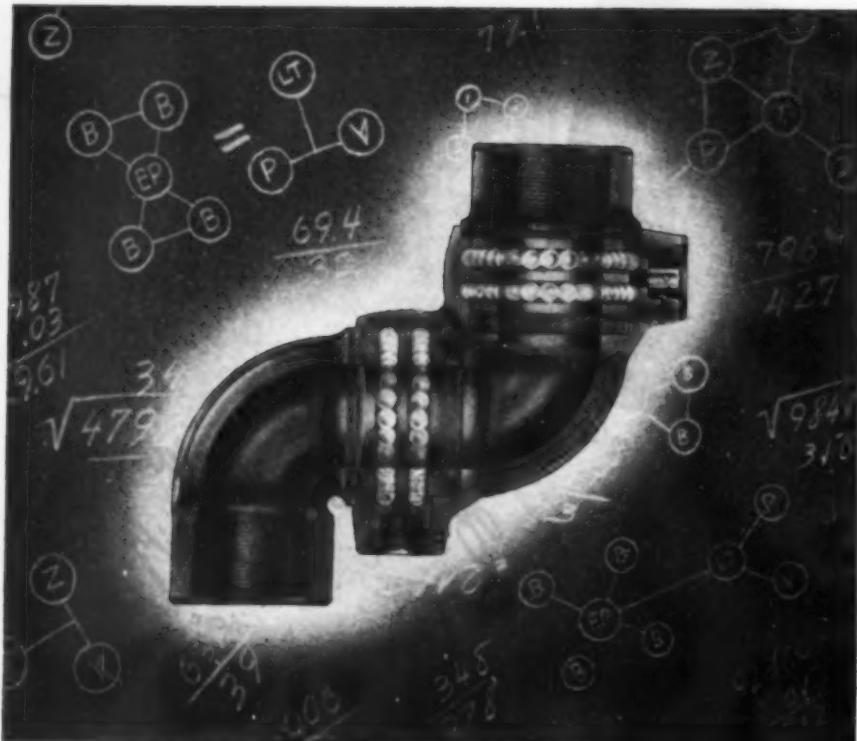
In their selection for this plant of a major gas company, Westcott-American orifice meters and Reliance pressure regulators demonstrate once again the confidence which their records of exacting performance have earned.

Westcott-American master orifice meters and three eight-inch-spring-loaded Reliance regulators controlling high-pressure gases.

The simplicity of Westcott-American orifice meters and Metric-American flow controllers, which is basic in **AMERICAN** design, makes possible easier inspection and adjustment without interfering with any of the few operating parts.

These features assure low maintenance cost, which now takes on greater importance than ever before due to the shortage of experienced maintenance crews.





FORMULA for a Perfect SWIVEL JOINT

$$BB_2 + EP = \frac{LT}{P/V}$$

BB₂ = Double rows of Ball Bearings

EP = Effective Packing Element

P/V = Pressure or Vacuum

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CHIKSAN Ball-Bearing Swivel Joints are built to this formula . . . therefore, they automatically provide for swiveling or rotation with minimum torque under pressure or vacuum . . . at high and low temperatures. There is nothing to tighten or adjust. The same Joint can be used for both pressure or vacuum service because the Packing Element is self-adjusting.

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stuffs to select the one most suitable for their needs, and similarly plastics and paint producers are likely to issue definite specifications for articles they used to fit in with their production technique and specific requirements. Research activities started by many trade associations and consumers of chemicals are likely to have similar effects. Consumers who know their own requirements as a result of scientific study are certain to insist that the outcome of their investigations shall be taken into consideration by chemical manufacturers whose task it is to meet their requirements.

Paints with anti-insecticidal properties and cosmetics with therapeutical effect have been mentioned as examples of co-operation inside the chemical trades as a result of new developments in one particular sector. Similar tendencies will no doubt be the outcome of such developments in fields where chemical and other industries are interested. At present most of this work seems to be in the hands of a few big combines which are sufficiently strong both financially and industrially to apply their knowledge in new fields. It remains to be seen how the increased co-operation between different sectors of the chemical industry and between chemical and other trades will be effected among smaller firms.

ALGERIA LACKS ADEQUATE SUPPLY OF SULPHUR

FOR MORE than two years supplies of sulphur and copper sulphate have not been reaching Algeria in sufficient volume to take care of pressing needs. It is reported that considerable loss in vineyards has resulted from the scarcity of these materials. Annual consuming requirements for sulphur are estimated at 20,000 tons. Formerly sulphur was supplied by Sicily but the war reduced these shipments and only small amounts have been received in Algeria of late. It is probable that trade will be inaugurated with the United States.

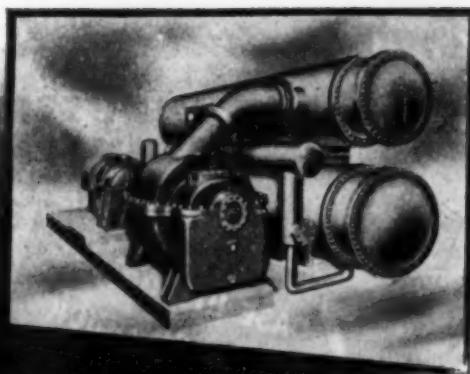
ARGENTINA EXPORTS MORE TARTARIC ACID

ACCORDING to the Director General of Statistics, the Argentine has been expanding its trade in tartaric acid with outside countries. Export data for the first ten months of 1944 indicate a gain of 25 percent in exports of the acid, the quantities being 1,038,956 kg. for 1944 and 828,338 kg. for the comparable period of 1943. Export business has been aided by the closing of markets which ordinarily furnish large amounts of the acid or of raw materials for its manufacture.

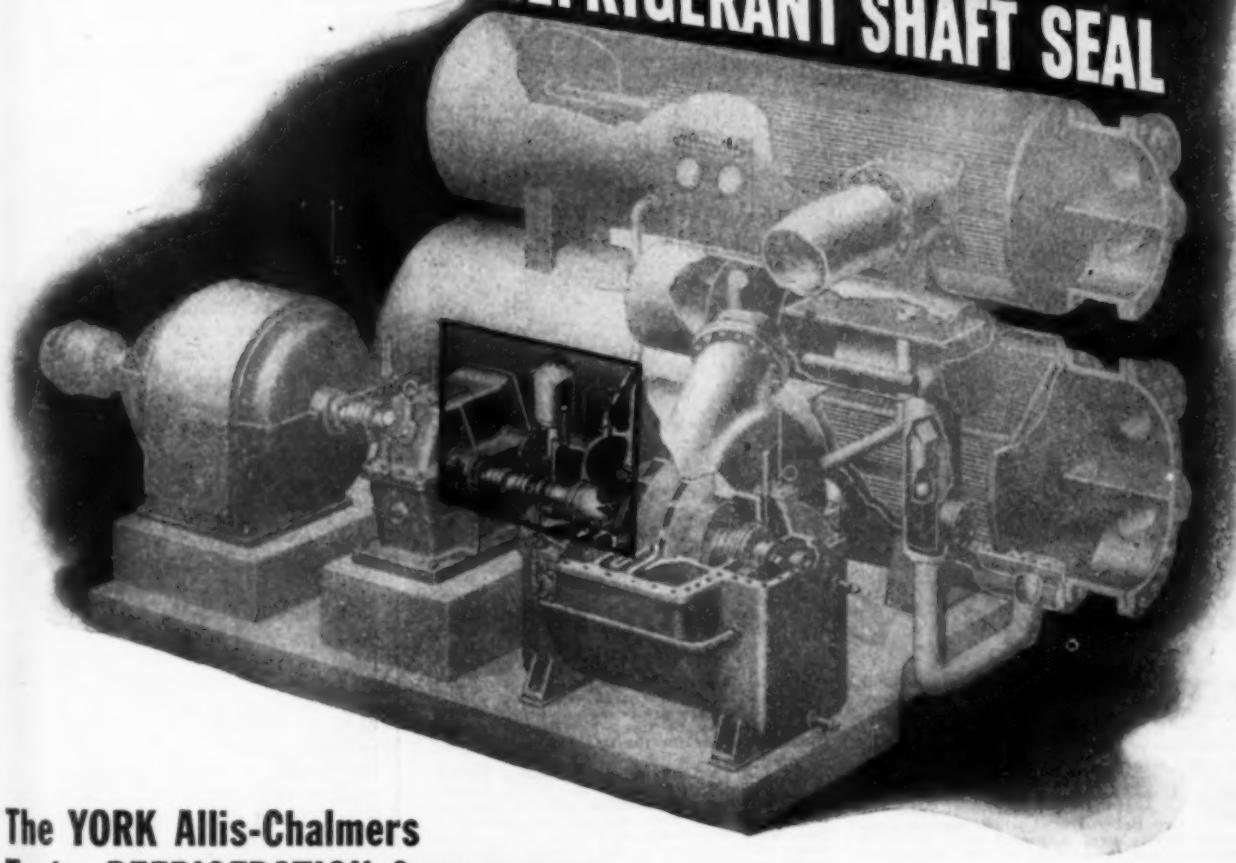
SWEDISH MATCH FACTORIES CURTAIL OUTPUTS

SEVERAL plants producing matches in Sweden have been operating on reduced schedules for a long time—some of them at 25 percent of the prewar rate—and do not expect to increase production until shipments can be resumed to outside countries. However, the factory at Västerås which had been closed since 1941 has resumed production but only to fill special foreign orders and it may not continue to

To Prevent Gas Leakage



Accurately Finished REFRIGERANT SHAFT SEAL



The YORK Allis-Chalmers Turbo REFRIGERATION Compressor

Two stationary carbon rings contact opposite sides of a special seal ring which rotates with the shaft for effective sealing. The seal surfaces are accurately finished and sealed with oil from the compressor lubricating system, thereby preventing leakage of refrigerant from the compressor—or air into the compressor. Pressure of the oil is maintained so that the seal is unaffected by changes of pressure due to ordinary operating conditions. The carbon rings are kept always in contact with the shaft seal ring. During shut-downs oil head on the seal is maintained by a gravity oil tank mounted above the seal housing. York Corporation, York, Pennsylvania.

Other outstanding features:

1. Stainless steel impeller blades resist erosion and corrosion assuring perfect wheel balance. Blade rivet heads are eliminated to provide unobstructed gas flow.
2. Low center of gravity of compressor—permitted by trough type cooler—cuts vibration, provides more accessible operation.
3. Balance piston to equalize wheel thrust makes necessary only a positioning thrust bearing, and results in less bearing friction losses.
4. Pre-rotation vanes permit greater capacity reduction (down to 10%).
5. Permanently silver-sealed condenser joints.



YORK REFRIGERATION AND AIR CONDITIONING

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885
CHEMICAL & METALLURGICAL ENGINEERING • MARCH 1945 •

How much are You paying FOR INDUSTRIAL TRUCK MAINTENANCE?



Checking wheel alignment is one of many easy maintenance operations which pays big dividends.

compare Your Costs WITH THESE:

The rugged construction of Baker Trucks, and the easy accessibility of all parts requiring service, result in unusually low maintenance costs. The following actual records are typical of many where regular inspection and lubrication are a matter of routine.

CASE NO. 1 A midwestern railroad paid a total of \$144.70 for replacement parts for two Baker Trucks which were in continuous service over a period of 7 years, 4 months—an average of only 82c per month per truck.

CASE NO. 2 A large motor truck manufacturer with a fleet of Baker Trucks, reports that during the last 5 years the total maintenance expense, on a truck purchased 26 years ago, exclusive of tires, has not exceeded \$50.00 per year.

CASE NO. 3 A large aircraft parts manufacturer bought 11 Baker Trucks 3 years ago for his huge new plant. Trucks operate 24 hours a day under most severe conditions. During the last 12 months (3 years of normal service) maintenance costs averaged \$350.00 per truck—a remarkable record considering that they had seen the equivalent of 9 years of grueling, uninterrupted service.

To help you reduce maintenance costs on your individual trucks, write for "Industrial Truck Care Pays You Dividends."

BAKER INDUSTRIAL TRUCK DIVISION of The Baker-Raulang Company
2145 West 25th Street • Cleveland, Ohio
In Canada: Railway and Power Engineering Corporation, Ltd.

CASE NO. 4 A wire mill reports that their Baker Truck, purchased in 1931, is still in regular service, and that maintenance cost—exclusive of tires—has been less than \$50.00 per year for the last 3 years.

CASE NO. 5 A food canner using a Baker Hy-Lift Truck purchased in 1931, writes: "Our superintendent tells us that surprising as it may seem, no new parts are necessary. Your representative told us what adjustments could be made—and it seems that they could do it right at the cannery. It looks like this is just one more blue ribbon for Baker. It is amazing that after all these years a general replacement of essential parts is unnecessary."

CASE NO. 6 A brass fitting manufacturer reports that his 4 Baker Trucks, in continuous service for 3 to 5 years have required no overhaul—and factory replacement parts, exclusive of tires, have averaged about \$10.00 per year per truck.

CASE NO. 7 A Baker Truck operating nearly four years in the plant of a transportation equipment manufacturer, has needed no major overhaul. Maintenance costs, in spite of severe service conditions, have totaled only \$150.91—less than \$40.00 per year.

operate when these orders are completed. The factory at Tidaholm was closed in 1940 but was reopened last summer to fill orders received from South America.

NEW ALUMINUM PRODUCTION REPORTED IN RUSSIA

THE Soviet press is authority for the statement that a new aluminum plant was under construction last year in the Northern Urals at the site of the Krasnaya Shchelka bauxite deposit at Bogoslovsk. The alumina plant was reported to be in operation in the final quarter of the year and production of metallic aluminum was scheduled to get under way by the end of the year.

COCONUT OIL PRODUCTION IN FIJI ISLANDS

PRODUCTION of coconut oil in the Fiji Islands has been confined recently to operations at a soap plant which formerly required all the oil it produced for the manufacture of soap. With a falling off in demand for soap, there is a surplus of oil said to amount to 400,000 lb. which might be exported if shipping arrangements can be made. Under current conditions it is expected that export surplus of 200,000 lb. will be available each quarter.

INDIA DEVELOPS NEW USES FOR SHELLAC

UNOFFICIAL reports say that the Indian Research Institute, Ranchi, India, has developed new uses for shellac. It can be used for coating aluminum discs and cylinders, glass, or other material. It was not found satisfactory as a binding material for abrasive wheels as its low melting point prevents the use of the wheels at high speed. Nor can it be used successfully for making waterproof emery paper because it is affected by prolonged contact with the water. The Institute, however, has devised a method for improving the qualities of shellac by chemical treatment. The material thus obtained is said to be free from the defects of natural shellac.

ANHYDROUS AMMONIA MADE IN SAO PAULO

In 1942, Companhia Nitro-Quimica Bonsucesso, an important manufacturer of nitrocellulose rayon and gun cotton in Brazil, began production of anhydrous ammonia. While the quality is not believed to equal that of the United States product, it has been accepted by Brazilian consumers and has supplied an important part of local requirements from the time production started. The company is completing an additional unit which will double its production. Anhydrous ammonia is used in the Sao Paulo district almost exclusively as a refrigerant. About 50 percent of total consumption is by meat packers, 20 percent goes to breweries and ice manufacturers, and 15 percent to chemical and textile plants. Of the remaining 15 percent, 10 percent is used by the dairy industry and 5 percent for miscellaneous purposes.

Baker INDUSTRIAL TRUCKS

TRADE MARK

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FIRE EXTINGUISHING SYSTEM

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At long last, C-O-TWO Modern Fire Equipment is available for industry in general. Many enterprising manufacturers know now that this all-out fire protection assures fast, positive fire-killing . . . without damage to materials or machinery. No clean-up or mop-up after a fire and no shut-down.

C-O-TWO smoke detecting and carbon dioxide systems, hand and wheeled units, hose rack and hose reel extinguishers have had a successful work-out with the Armed Forces. The trial by fire under the most exacting demands of war has proven that C-O-TWO can take it and hand it out. Write for particulars.

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It's Safer — It's Faster — It's Modern**

CORROSION FORUM

EDMOND C. FETTER, Assistant Editor

LITERATURE REVIEW

U. R. EVANS, "Metallic corrosion," *Iron & Steel*, Nov. 1944, pp. 686-690:—Corrosion research is particularly important at the present time, since the solution of certain outstanding problems is likely to decide whether iron and steel will have to be abandoned in certain situations in favor of more expensive materials. Three sets of corrosion problems are being studied in the Cambridge University Corrosion Research Section. These are:

(1) Protection of iron and steel carrying mill-scale residues, rust, water and possibly grease. Such surfaces can be protected: (a) By removing the foreign matter mechanically or chemically; shotblasting has certain special advantages. An excellent protective system consists of shotblasting followed by aluminum spraying from a wire pistol, with a final coat of paint on the sprayed surface. (b) By the development of paints suitable for direct application to contaminated surfaces. Of those under study at Cambridge, cementiferous (inorganic) paints, and organic paints so richly pigmented with zinc dust as to constitute a conducting layer, have shown promising results. Specimens of rusty steel carrying a single coat of zinc-rich paint applied outside the rust with a scratch-line penetrating the coat so as to expose the bright steel, have been kept in sea water for two years without the production of any fresh loose rust.

(2) Safe and efficient inhibitive treatment for cooling systems. Whereas cathodic inhibitors are usually inefficient, and anodic inhibitors are apt to be dangerous (intensifying attack if added in insufficient amount), it seems likely that the alternate use of the two may provide a combination which is both safe and efficient.

(3) Corrosion fatigue. Experiments have shown that steel subjected to alternating stresses may have a shorter life if exposed to corrosive conditions for a short period, followed by the exclusion of corrosive influences, than if the corrosive influences operate throughout the whole period of stress. This emphasizes the danger of relaxing precautions against corrosion even for short periods. If corrosive influences can be excluded completely, there should be no breakage, provided that the stresses are below the fatigue limit. Zinc-rich paints considerably prolong the life of specimens exposed to alternating stresses in a corrosive environment, although they do not prevent corrosion fatigue altogether.

J. F. J. THOMAS and A. C. Halferdahl "Comparative corrosion resistance to seawater of low-alloy, high-strength steels,"

Canadian Chemistry and Process Industries, Jan. 1945, pp. 43-48:—A dozen steels containing small amounts of Cu, Ni, Cr, and/or Mo (less than 2 percent of any one) were exposed for two years to seawater both in the laboratory and at the Atlantic and Pacific sea coasts. After briefly summarizing previous studies, the authors discuss fully and frankly their test procedures and the significance of their determinations. While the addition of small amounts of alloying metals appears in general to have a beneficial effect, there is no pronounced indication that one is any better than another for the purpose. Picking typical data to give a general idea of what the tests revealed, it is observed that under one set of conditions (immersion in the Pacific) the difference between the best steel (1 Cr, 0.4 Cu alloyed) and the worst steel (plain mild steel) was the difference between 7.3 and 10.6 gm. per sq. dm. per yr. (0.004 and 0.006 ipy.).

"PRACTICAL pointers for preventing concentration cell corrosion," *Steel*, Nov. 13, 1944, p. 136:—Observance of several simple precautions will avoid rapid attack which takes place in crevices, beneath scale and other deposits, and under rivet heads.

O. C. RODDEY and L. R. Sheppard, "Thirteen years of corrosion mitigation," *Oil and Gas Journal*, Sept. 23, 1944, p. 210:—Cathodic protection of underground equipment by externally impressed voltages; case history of 13 yr. old pipe line so protected.

D. T. MACROBERTS, "Cavitation as a possible cause of internal corrosion," *Oil and Gas Journal*, Sept. 23, 1944, p. 239, 13 references:—Where metal parts are exposed to fast-moving gases carrying condensed or entrained liquid, the removal of metal may be due to erosion as well as corrosion. Laboratory tests and field observations indicate that it might easily be the rapidly repeated formation and collapse of "vacuum" pockets which causes destructive bombardment of liquid against metal.

CORROSION REPORTER

THREE manufacturers were interviewed for the Forum this month. The first, speaking for a large producer of fine chemicals, says: "We use nitric acid in a great range of concentrations, and like most people find that stainless steel is satisfactory. At room temperature we handle solutions from 0 to 71 percent, and at 135-deg. F. we handle a 50 percent solution. In all our pumps, pipes, fittings, etc., for these solutions, we prefer to use stainless type 316 but have found type 304 to be almost as good and much easier to get.

"For the last three or four months we have been using a rubber-like product known as Tygon, in contact with nitric acid at all concentrations up to but not including fuming. So far this seems to be an excellent material for gaskets, syphon tubes, etc. A related product, Tygon paint, is giving splendid service in exhaust systems as a protective covering for fans and ducts handling such highly corrosive and strongly oxidizing fumes as those of chlorine and nitric acid. For example, a Duriron fan exhausting Cl₂ lasted three to four months. Replaced by Durichlor, the fan lasted only one or two months. Coated with a clear Tygon varnish, a Durichlor fan is still in service after one year. Our only objection to Tygon paint is the difficulty encountered in applying it. Bakelite varnish is almost as good and is many times easier to apply.

"In one of our processes a highly concentrated solution of mercurous nitrate (HgNO₃) is brought to a temperature of 400 deg. C. After testing more than 10 different metals to do this job, it was found that only stainless 316 and an alloy known as Pyrocast (ferrous alloy containing 22-30 percent chrome) would resist corrosion sufficiently to give us an iron-free product.

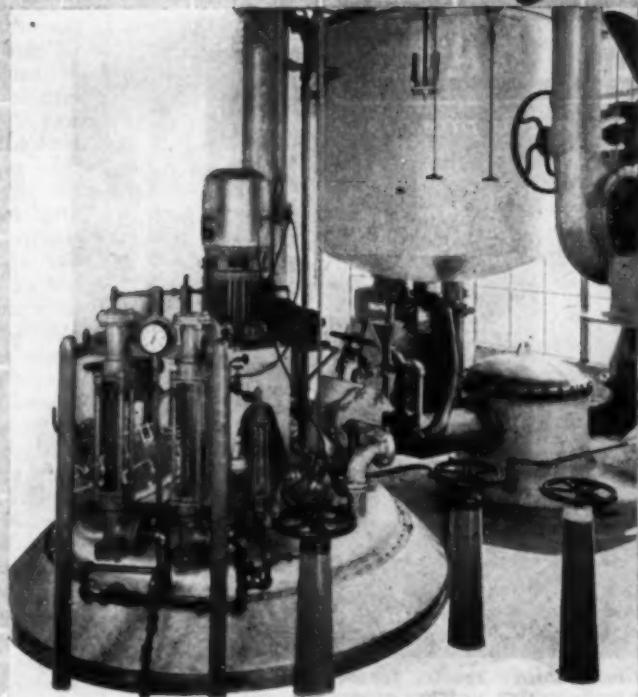
"Bichloride of mercury (corrosive sublimate) viciously attacks all metals even when the powdered product is apparently dry. We have heard that tantalum may be usable but have not yet had an opportunity to try it, glass and chemical stone ware being the only two materials which we permit to come in contact with HgCl₂.

"Our 20-deg.-Bé. hydrochloric acid has for the last eight or ten years been stored in a Haevig tank. This replaced a steel tank lined with natural rubber which after seven years of service had to be discarded, not because the rubber lining had failed, but because the steel in the tank itself had been corroded."

Our second informant, the chief engineer in a chemical plant, reports: "In one of our processes we encounter sulphuric acid (with about 1 percent free sulphuric acid) in all concentrations from 5 to 50 percent and all temperatures from cold to boiling. All solutions within this range are handled well by the following materials: Elcomet K for pumps and other castings; Everdur or copper for piping; zinc-free bronze for pipe fittings; Monel for certain centrifuge parts, baskets and shafting; and lead for tank linings.

"We have occasion to use sulphuric acid at concentrations from 5 to 50 percent and at temperatures from cold to boiling. For this service we have used a lot of tellurium lead and have found nothing to recommend it above chemical lead. In

Dowtherm on the job!



Only Dowtherm could solve all these heat-processing problems

A few years ago a West-coast manufacturer faced a tough combination of production problems. He required a heat-processing system that would eliminate the charring and discoloration of his product . . . that would provide for partial cooling during the processing . . . that would give highly accurate control of temperatures in exothermic reaction . . . and, at the same time, would reduce production costs. Quite an order! Yet Dowtherm was versatile enough to fulfill every one of these requirements.

In many different industries, hundreds of processors whose operations call for precise heat-control in

-725°

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the 400°-725° F. range have had similarly gratifying results with Dowtherm liquid or Dowtherm vapor systems. If you are interested in eliminating costly shutdowns . . . in the safety of high-temperature-with-low-pressure . . . in uniformity and possible improvement of product . . . in processing at several different temperatures simultaneously from one heat source . . . in reducing production and maintenance time and costs—then a note to Dow should be your next step.

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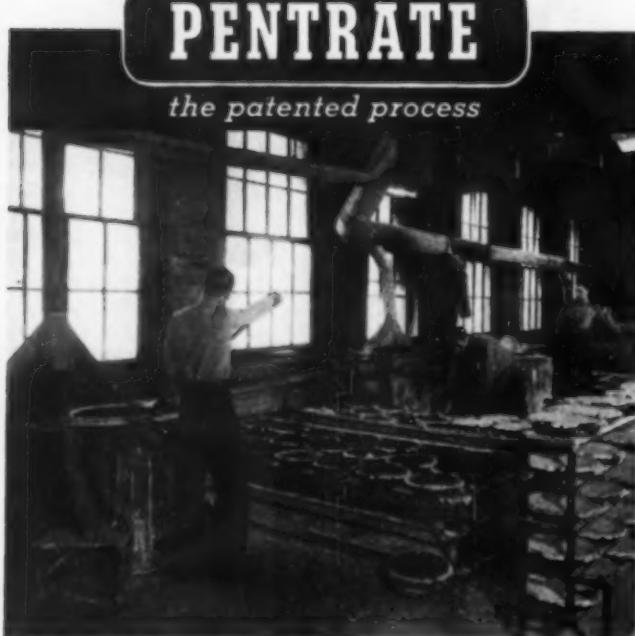
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More than 20 years of constant research in Heatbath laboratories enable Pentrate to offer the most in economy in speed and production work. The inherent stability of Pentrate solutions requires no energizers or periodic solution renewal.

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HEATBATH CORPORATION

Springfield 1, Massachusetts

fact, tellurium lead has the disadvantage that the lead burners who fabricate it have greater difficulty in producing a seam which will not open up.

"We have no difficulty in manufacturing bichromates, using carbon steel throughout—even in contact with a solution which is 60 percent bichromate and 1-5 percent sulphuric acid.

"Another of our corrosives is a widely variable solution consisting of chromic acid (2-100 percent) mixed with sodium bisulphite (1 percent to saturated solution) and handled at temperatures up to 150 deg. F. Durimet seems to be best suited for the application and is used exclusively for pump and valve parts. Lead and 18-8 stainless are also satisfactory, and are used for those parts of the equipment which are not produced as casting. While 18-8 stainless is satisfactory here, where at least 2 percent chromic acid is present to act as an inhibitor, we are certain that it would not be satisfactory in the presence of sodium bisulphite alone."

Much the same story is told by the plant supervisor of another manufacturing establishment also engaged in the production of bichromates: "The manufacture of sodium and potassium chromates and bichromates is one in which the problem of corrosion is almost non-existent in that the product is in itself a corrosion inhibitor. All through the process of manufacture, from the time the chromite ore from S. Africa is roasted with soda ash and lime, then leached to obtain Na and K chromate, and even after this solution is oxidized with H_2SO_4 (60 deg. Be) to form bichromate and the bichromate is crystallized out of solution, plain carbon steel is completely satisfactory.

"Sodium sulphate is a byproduct of the process. Before purification it is in saturated solution, and about 0.3 percent of bichromate is present as an impurity. Pumps, tanks and pipes handling this solution last five to six years. They are made of plain carbon steel. The bichromate impurity is removed by reducing it with sulphur dioxide gas in a ceramic-filled tower. After reduction and precipitation as hydrate, the chrome is removed by filtration in an iron Kelly press.

"Once the bichromate, which never amounted to more than 1 percent of the sodium sulphate solution, is completely removed, the solution becomes too corrosive to be handled in plain carbon steel—that is, if it is desired to produce Glauber salt which is not contaminated with iron. Our evaporator, therefore, is made of Monel metal. Copper, which would seem to be satisfactory from a chemical point of view, is not used because ours is a forced-circulation evaporator and at high velocity the sharp sodium sulphate crystals would erode it. The centrifuges and dryers which follow the evaporator in the process are lined with Monel or 18-8 stainless steel and here again plain carbon steel might be used except that we require a pure product. Furthermore, we find that in the case of expensive equipment like evaporators, centrifuges and dryers it is more economical to stand the higher first cost of the alloy than to replace periodically the same pieces of equipment made of ordinary carbon steel."



CRACKS DOWN ON CRACKED VALVES

SOLNUS OILS . . . eliminate hard carbon . . . compressor valves last 3 years instead of 1 month

Every overhaul today delays production tomorrow . . . and when it is an important piece of equipment such as an air compressor, reducing shutdowns is a "must."

Hard carbon formed, valves cracked and new ones had to be installed at least once a month on a single-stage, 40 pound compressor in a New Jersey plant. The compressor was "taken down" for cleaning every four months. Then the maintenance men took the advice of a Sun Oil Engineer — a switch was made to Solnus Medium Oil.

Now, valves last for three years instead of cracking and being discarded in one month.

Once a year the compressor is checked and cleaned. There is no hard carbon and valves are practically clean.

Reduce shutdowns in your plant by eliminating the unnecessary overhauls that are often caused by faulty lubrication. Solnus Oils, with their high lubricating and wear preventing qualities and Sun Oil Engineering service, offer you a combination proved by hundreds of industrial plants to be the answer to keeping production at its peak. Call in your local Sun Engineer today or write to . . .

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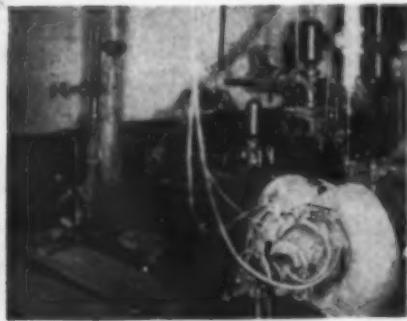


SUN INDUSTRIAL PRODUCTS

OILS FOR AMERICAN INDUSTRY

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer



Museum pieces now, this bi-polar motor and belt-driven suction pump succumbed to the company's program of equipment standardization

TO DISCARD a faithful old pump and replace it with a new one disturbed the Old Man. During the years, he had developed a friendly feeling for the old pump while the new one excited the antipathy of a stranger. In '21 the Chronicler had inherited about 150 assorted pumps with scarcely an identical pair in the lot. Among the centrifugal pumps there were end suction, double suction, belt driven and a few motor connected. The graveyard still contained a pioneer double suction De Laval, one of seven furnished from Sweden when the plant was built in 1902. This pump had a speed of 3,200 and was direct connected via a gear reducer to a steam turbine operating at 32,000 rpm. The turbine runner was 4 in. in diameter and delivered 7 hp. Some of the end suction pumps with overhanging pulleys were driven by Crocker & Curtis (predecessor of Crocker-Wheeler) bi-polar motors which the boys dubbed harps (see illustration). One of these motors and one of the De Laval pumping sets can now be seen in the Franklin Museum. Stations which required continuity of operation were equipped with two pumps.

To overcome this harassing condition, a complete schedule of new pumps was prepared and a supplier selected. The specifications called for direct motor drives, heavy shafts, antifriction bearings, and large impellers for motor speeds (d. c.) of 850, 1,150, and 1,750 rpm. Mechanical efficiency was considered comparatively less important than robust construction since homemade power, from which by-product steam is extracted, costs only about 4¢ per kWh. There are only four sizes of centrifugal pumps for water and sugar liquors in the plant now, namely, 2, 3, 4 and 6 in., and no more. The casings are large, the 4 in. size, for example, being able to accommodate impellers varying from 11 to 17½ in. in diam-

eter, thus providing for any demand as to head and volume. Many stations that can shut down for a half-hour without loss in plant output now have only one pump instead of two, since a standard pump, built to jigs, can be taken off its foundation bolts and replaced with a new one in thirty minutes. A few spare pumps of each size and an assortment of impellers, shafts and bearings relieve the plant engineer of worry and require little space in the storeroom. Many of the pumps have bronze casings which can be built up with bronze electrodes and re-machined when they have become worn.

It required patient years to complete the program of standardizing the installations. To expedite it, all of the wiles known to the plant engineer were employed including the requisitioning of large quantities of parts which were later assembled into complete units. The plant was performing at full capacity and the books could stand the exaggerated "Repair and Maintenance." The old pumps were promptly converted into junk lest the temptation might occur to return them from the graveyard. The good old direct-acting steam pumps were thrown out by the ton in spite of their advantage of perfect speed regulation. A direct acting pump is a voracious steam consumer, and on occasional idle week ends a forgetful oiler has sent a gallon or two of oil into a steam cylinder to reappear later in the feed water. For heavy sirups, power driven, geared plunger pumps were selected as well as rotary. For oil, rotary pumps are used. Besides these, there are a few special pumps for acids, lime milk, and abrasive kieselguhr slurry—but for every service there is a standard.

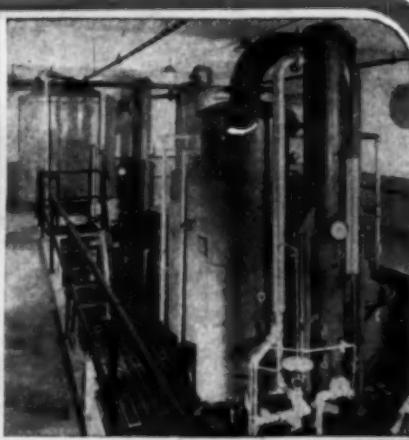
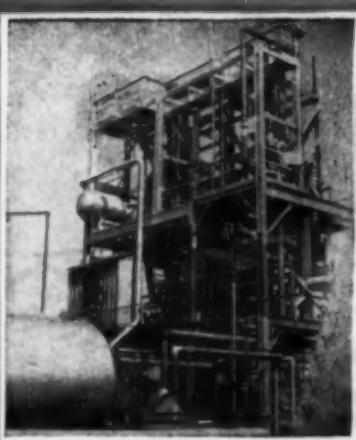
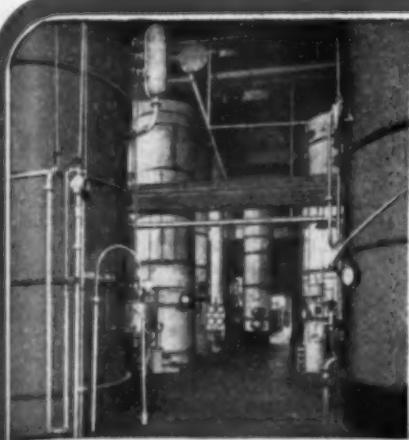
AS THE OLD WORKS GREW and expanded, new units of mechanical devices had been installed without thought of standardization. Eventually, the house was cluttered with a confusion of power drives in the way of gears, chains, belts, shafts and bearings. The first move toward simplifying the hodgepodge was to make a complete list and drawings of standardized devices. Shaft sizes were limited to 1½, 2½, 2¾, 3½ and 3¾ in., with larger sizes for headshafts as required.

Each size of shaft calls for a complement of accessories. An internationally known line of antifriction bearings, made within an hour's distance from the refinery, was selected as the plant standard. All drive chains of every make and style were discarded and replaced with manufacturer's standard steel roller chains and, except in the case of small machinery, these include only 1, 2, and 2½ in. pitches with some heavy drives using double widths. Sprocket sizes advance in mul-

tiples of six teeth, i.e., 12, 18, 24, 48, 54, 72 and 84, and there are no others. When one of these requires replacement the mechanic can detect by a glance the number of teeth he needs and there is sure to be a spare in the store room. The hubs are made large enough to take the largest bore for which a particular size is used. Standardization is applied to some extent to pulley diameters. V-belts are selected as to size and lengths and the drafting room schedule limits the variety of these. Sheave diameters must suit speed ratios but when the list is kept up-to-date, many duplications are possible. For motor drives exceeding practical speeds of roller chains, V-belts or silent chains are used. There are four silent chain drives delivering from 400 to 600 hp. at a speed of 4,500 ft. per min. These are alike and there is one spare in the store room. It is more economical to duplicate even if one drive is underloaded. Providing spare gear reducers is costly but it is justifiable if there are a number of the same size in use.

HONESTY IS THE BEST POLICY, but since there is widespread satisfaction with mediocrity in this respect, it is customary to provide locks on doors and tool chests. There are 1,000 mortise and padlocks in the refinery, no two of which use the same key but all respond to two master keys on the plant manager's ring. Sub-master keys are also available for department supervisors. The key cabinet in the drafting room contains a sample of each individual key and there is provided a key cutter for duplication. The cutter was formerly installed in the machine shop. During an unguarded moment it was left on the bench whence it suddenly disappeared, presumably to establish some sugar maker in a profitable side line!

STANDARDIZATION obtains profitable results in reducing store room inventories. For every make of valve, steam trap or other specialty, the pigeon holes must contain a complement of spare parts. A standard is the best for the time and is subject to change, but elemental units do not change frequently. The standard devices continue to serve valiantly throughout their life and when a machine is finally dismantled for scrap, the standardized parts in the way of gears, gear reducers, chains, sprockets, bearings and motors go right back into live storage at full value. A certain roller bearing, 3½-in. bore, is used for eight coal pulverizers, five 48-in. centrifugals, and four 600-hp. turbines—34 bearings in all, and the store room contains four spares. Recently, the delivery of a new turbine would have been delayed two months had not the turbine manufacturer been able to borrow from



ACME FACILITIES AND ENGINEERING *Serve many Process Industries!*

COMPLETE
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Acme experience extends to many old and new process industries. In such diverse fields as Vitamin Extraction, manufacture of Organic Solvents and Heavy Chemicals, many successful installations serve to demonstrate Acme versatility.

From design to operation, Acme is thoroughly equipped to handle any process problem. Modern tools of production, skilled craftsmanship, sound and creative engineering—all play a part in the outstanding performance of Acme equipment. Each unit is designed to operate with maximum efficiency under specified working conditions.

Whether the problem is one of precision fabrication, or one entailing research and creative engineering, Acme has the facilities, the personnel, the "know-how" to assure the most efficient solution.



ACME

Processing Equipment

ACME COPPERSMITHING & MACHINE CO., ORRLAND, PA., U. S. A.





● Time was, and not so long ago, when a blazing oil quench tank was no easy thing to subdue—and the resulting loss in money, production hours and output was prodigious.

Then came FIRE-FOG and a new era of fire protection was ushered in.

This system of fire quenching is seemingly miraculous in its ability to deliver a quick, "knock-out" blow to flammable liquid fires. In only a few seconds of time a blazing tank is completely extinguished and the action is entirely automatic.

Here's how a FIRE-FOG

system works: FIRE-FOG nozzles are strategically placed to cover the fire hazard areas. No sooner does fire break out than a mist-fine spray of water attacks the burning area. Action is swift, sure and automatic. The flames are beaten down; an enveloping blanket of spray causes oxygen starvation and smothers the blaze; almost immediately the fire is extinguished.

Little wonder American industry has been quick to recognize the fire-fighting potency of FIRE-FOG—it blankets—it isolates—it quenches.

"Automatic" manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Write for complete information—we'll furnish it cheerfully.

"Automatic"
SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN, OHIO . . . OFFICES IN 31 CITIES

our stock room certain vital bearings which were otherwise unobtainable.

The job of converting an old works to new standards may appear forbidding, but ten years of patient effort toward a set goal will show amazing results, and the plant engineer who practices the necessary foresight will win the everlasting gratitude of his successor. The only kick that has ever come to the Chronicler's notice came from salesmen of competing makes. But a salesman is not called to the works at least twelve to grovel through the store room for a substitute for some odd part of a myriad of devices.

STANDARDIZATION AT HOME is also a profitable practice. For 25 years the Chronicler has ordered shoe replacements by phone according to specification on file at the maker's establishment. When use on the street has dimmed their dignity the shoes are relegated to service for the work-a-day job at the refinery. Sometimes a left sole of one pair and a right sole of another simultaneously develop chisel holes. In such a case the defective individuals are discarded, leaving a matching pair for continued usefulness.

EVERY PLANT ENGINEER occasionally enjoys the satisfying experience of finding that an installation attains not only the improvement sought but also some collateral advantage! Thus, standardization of mechanical devices reduced the cost not only of materials but of labor as well. Furthermore, the procedure of reusing and discarding obsolete parts gave opportunity to improve. A device that required replacement in six years now last for twelve or more. The six year job cost more than twice as much as the twelve.

IF ANY BROTHER has any doubts about the claims for standardization, let him try it! He may require a couple of five-year plans running consecutively; he may run into some arguments with the purchasing agent and he may even have to lie a little, but, if he lives long enough, he'll have the satisfaction to hear the erstwhile critics beat their breasts and brag that they themselves suggested it to the man many years ago!

A SUPERVISED SPRINKLER valve in the dock fire system recently provided the impulse to illustrate the power of suggestion. Because of some defectiveness, the alarm of a water flow fetched up on the ADT switch board. There was no fire but in a few minutes the fire engines turned down Shackamaxon Avenue and halted in front of the granary. The superintendent's clerk called up to advise that the engines were out in front. He was unable to direct the firemen to the fire, but he could smell the smoke.

"HORSEPOWER" on the Southern sugar plantations in 1880 was supplied predominantly by the plodding mule. Some 50,000 of these hybrids constituted the entire life and motive power of the agricultural division of the cane sugar industry of the South. The trade journals discussed the mule's mechanical features and his operating efficiency and cost in

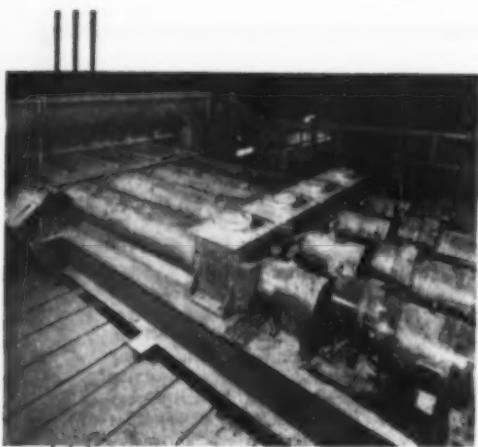
Paper Needs Alkalies



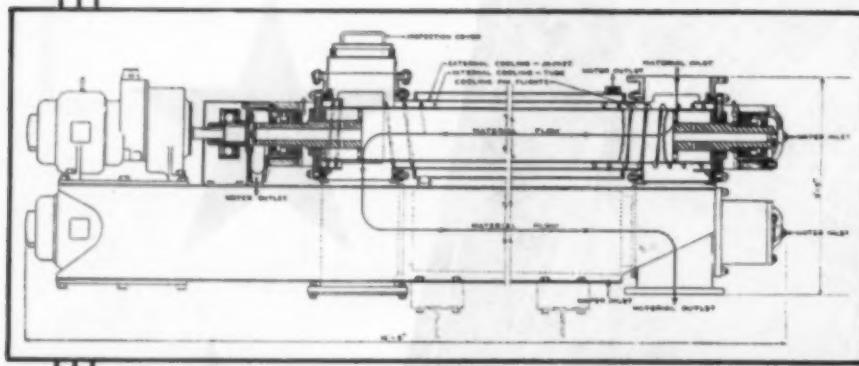
From the first rough draft to the master blueprint—tons of paper go into the making of the Navy's big ships and other machines of war . . . and into the all-useful shipping containers which carry vital supplies. In the chemical processing of paper Solvay Alkalies and related products play an important part. In war as in peace alkalies are indispensable!



SOLVAY SALES CORPORATION Alkalies and Chemical Products Manufactured by The Solvay Process Company



FULLER DRY PULVERIZED-MATERIAL COOLER



Write for Bulletin PMC-1.

The Fuller Cooler was developed and built principally for the cooling of finished Portland cement. Also for the elimination of difficulties encountered in handling and storing hot materials. Installations have now been in successful operation over an extended period in the cement and chemical-process industries.

The cooler is simple in design, efficient, low in power consumption and maintenance. Each unit has a normal rated capacity of 50 barrels (200 cu. ft.) Portland cement per hour. Water is used as a cooling medium.

Temperature reductions are mainly dependent on initial temperature of material to be cooled, quantity and temperature of water available.

FULLER COMPANY CATASAUQUA, PENNSYLVANIA

Chicago 3 - 1144 Marquette Bldg.
San Francisco 4 - 421 Chancery Bldg.
Washington 5, D. C. - 618 Colorado Bldg.

PMC-10

FULLER-KINYON . . . FULLER-FLUXO . . . THE AIRVEYOR CONVEYING SYSTEMS . . . ROTARY FEEDERS AND DISCHARGE GATES . . . ROTARY AIR COMPRESSORS AND VACUUM PUMPS . . . AIR-QUENCHING INCLINED-GRADE COOLERS . . . DRY PULVERIZED-MATERIAL COOLERS . . . MATERIAL-LEVEL INDICATORS . . . FULLER AERATION BLOCKS . . . SLURRY VALVES . . . SAMPLERS

as gas engines are now discussed. His availability under average conditions was reported as 150 days per year, but this was possible of increase by kindness, appreciation and improved living conditions. Under the heading of "field equipment" a planter submitted his experiences as follows:—"The mule is superior to the horse in that he is longer lived, surer footed, more resistant to disease, less subject to fatigue and less finicky about his food. He is a better worker, not spoiled by running away and he responds to curry comb and brush. His only disadvantages are his lack of glamour and his squeaky voice."

THE WIZARD of the electric shop answers the telephone and an excited voice with a Slavic accent hollers, "She's burned up again!" The Wizard queries, "Where?" The answer comes back, "Here!" While the Wizard is trying hard to locate the source of the alarm, the "polander" hangs up in ill temper. Meanwhile the whir characteristic of a certain machine has come over the wire and a trouble shooter is dispatched to the right spot.

Less successful is the Wizard's effort to prevent theft of light globes. He has tried all of the commercial devices including the use of 220-volt globes and etching thereon, "Stolen from the Sugar House." Last week one of his men, exasperated with the call for frequent replacement in a certain dark corner, chalked on the wall below the globe, "I know who steals these lights." The next day the globe was gone again, and below was written the answer, "You're a liar!"

GEORGE HOEPNER, originator of the widely used automatic packaging scales, was the boss in his shop in Chicago. He was also the chief designer and the sole owner of the works. Only one other transcended him in authority and that was Mrs. Hoepner. She administered the accounts. When business expanded so that Hoepner could no longer cover the field in erection of the machines, he installed right-hand-man Cullom as service expert. By way of introduction he directed Cullom to "tell the Old Lady" to count out \$500 for traveling expenses. At the conclusion of the first trip, Cullom rendered a statement of his expenditures. Hoepner promptly cast it into the waste basket with the remark that he could not be bothered with such trifles. Thereafter the mechanics of Cullom's bookkeeping were his conscience and his left hip pocket.

A CARGO of white sugar was delivered in San Francisco from Java during the last war. The crystals were unusually large and possessed a grayish cast which created customer prejudice and therefore depressed the price. A crafty broker bought the cargo and cracked the crystals through a grinder. The cracking process imparted whiteness to the sugar and thus the broker's wisdom and the consumer's lack of it turned the Javanese cargo into a profitable undertaking. The salesman even convinced the buyer that the Javanese sugar was sweeter than the American brand! He put some on his tongue and sure enough. The ignoramus failed to appreciate the fact that the fine grains melted more rapidly on his tongue.

WORLD'S LARGEST PRODUCER of Stainless Steel Welding Fittings



THE Stainless Steel Division of Pittsburgh Piping & Equipment Company manufactures a complete line of stainless steel welding fittings. 45° and 90° Elbows, 180° Return Bends, Reducers, Tees, Caps, and Lap-joint Nipples, are available in Stainless Types Nos. 304, 316, 321, 347; also furnished in other analyses. I.P.S. sizes range from 1/2" to 10"; tube sizes from 1" to 24" diameter.

These fittings are annealed, blasted, and passivated for best corrosion resistance. The ends are

accurately machine cut and beveled to 37 1/2° with approximately 1/16" straight face. The radius of each Elbow is 1 1/2 times the nominal pipe diameter.

Use of Pittsburgh Piping & Equipment Company Stainless Steel Fittings assures dimensional accuracy in your sub-assemblies and greatly simplifies field erection.

Send us your specific requirements. We will give you complete information promptly, without obligation.

STAINLESS STEEL DIVISION
Pittsburgh Piping
AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Oriental Building, Indianapolis
Bank Tower, Detroit
525 Market Street, San Francisco

Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston



DO MORE THAN BEFORE—BUY EXTRA WAR BONDS

NAMES IN THE NEWS



R. W. Porter

Richard W. Porter has joined the staff of Chem. & Met. as assistant editor. For the past two years he has been employed by the Brown Instrument Co. in the application engineering division in Philadelphia, Pa. Previously Mr. Porter had been with Crown Zellerbach Corp. for six years in its pulp and paper mills at Port Townsend, Wash., and Carthage, N. Y. Mr. Porter is a 1936 graduate of the University of Washington, Seattle.

F. D. Chittenden has been appointed to the newly created position of factory manager of the Naugatuck synthetic rubber plant of the U. S. Rubber Co. Dr. Chittenden has been with the rubber company since 1926 and has been in Naugatuck since last September as a member of the technical coordination staff of the synthetic rubber division.

William F. Thiede has been appointed manager of the New Jersey Works of the Standard Oil Co. of N. J. succeeding the late G. H. Mettam.

Edmund L. Del Conte, a member of the March, 1945, graduating class of chemical engineers of the School of Science & Technology, Pratt Institute, Brooklyn, N. Y., has been announced the winner of the Winship prize.

Arthur M. Miller has been appointed assistant to the president of Rohm & Haas Co. of Philadelphia. Mr. Miller is a graduate of MIT and of Harvard. He comes to his new position from TVA where he has been director of the department of chemical engineering since 1938.

Eldon G. Constans has been appointed ceramic engineer on the staff of the Edward Orton, Jr. Ceramic Foundation at Columbus, where he will carry on research work on the development of the use of standard pyrometric cones.

Marston T. Bogert, professor emeritus of organic chemistry in Columbia University, has been elected an honorary member of the American Institute of Chemists.



A. M. Erskine

A. M. Erskine has been named director of research and development for The Paraffine Cos. and their associate Plant Rubber & Asbestos Works. Dr. Erskine has been associated with E. I. du Pont de Nemours & Co. for the past 16 years. He will maintain his headquarters at the company's main plant in the San Francisco area.

W. L. Badger has resigned his position as manager, Consulting Engineering Division, Dow Chemical Co., to go into private consulting work. He is still giving a portion of his time to Dow problems, but is also accepting outside connections.

Elias I. Kelsey is now associated with The Greist Manufacturing Co. of New Haven, Conn., as chief engineer. Mr. Kelsey spent 12 years as field engineer with Du Pont's Industrial Engineering Division. More recently he was a staff engineer with the Remington Arms Co.

Edwin F. Nelson, head of engineering and development department of Universal Oil Products Co., has been elected a vice president of the organization.

Sidney J. Robison has joined the staff of the Western Precipitation Corp. with headquarters in Chicago where he will devote his time to special problems relating to adaptation of Cottrell precipitators and Multiclines in the heavy industries. Mr. Robison was formerly chief engineer of the Universal Atlas Cement Co.

John T. Stearn has accepted a position as chemical specialist with the International Business Machines Corp. Dr. Stearn is establishing a chemical laboratory in New York for development work on plastics.

Lucas P. Kyrides, research director of the organic chemicals division of Monsanto Chemical Co., has been chosen as the first recipient of the Midwest Award of the St. Louis Section of the American Chemical Society. This award will be given each year for meritorious contributions to the advancement of pure or applied chemistry or chemical education.

S. D. Kirkpatrick, editor of Chem. & Met., left the United States early in March for Great Britain and the continent. He is on a mission for the War Production Board.

James E. Bacon, formerly head of the non-metallurgical section of the Mining Division of WPB, left WPB last month to open his own consulting office in Washington.

Homer E. Kieweg has been appointed chief engineer of the Commercial Solvents Corp. A chemical engineer from the University of Wisconsin, he has been in charge of various CSC research, engineering, and production activities during the last 12 years. He was previously superintendent of the penicillin plant at Terre Haute, and George E. Hines has been promoted to fill that position. Other recent appointments announced by CSC are: J. Eckard Wheeler, superintendent of the Terre Haute, Ind. plant; Roy C. Mitchell, process superintendent; and T. Earl Drake, superintendent of the derivatives plant.

Arthur R. C. Markl has been named chief research engineer for Tube Turns, Louisville. Before joining Tube Turns Mr. Markl was associated with the M. W. Kellogg Co.

Stewart W. Richards, counsel for the WPB Chemicals Division has been named an assistant general counsel of the War Production Board.

William H. Safranek, Jr. has been appointed to the staff of Battelle Memorial Institute, Columbus, where he will be engaged in electrochemical research.

J. E. Zanetti has been awarded the Legion of Merit. Colonel Zanetti, who is professor of chemistry and director of the chemical laboratories at Columbia University, is in the Chemical Warfare Service and the award was made for exceptionally meritorious conduct in the performance of outstanding services from July, 1941, to September, 1944.

Arthur H. Compton, dean, division of physical science and chairman, department of physics, University of Chicago, has received the Washington award, a presentation made annually by the Western Society of Engineers in recognition of service in advancing human progress.

Donald Price, who for the past year has been connected with Interchemical Corp., New York, and who for many years previous was director of the organic research laboratory, National Oil Products Co., has been appointed technical director of Oakite Products, Inc., New York. In his new position, Dr. Price will head Oakite's technical division.

Howard A. Somers of The Mathieson Alkali Works has been made chief engineer of the corporation with headquarters in New York.

DICALITE FILTERAIDS *at work*

... why they speed production
improve processing and
reduce costs.

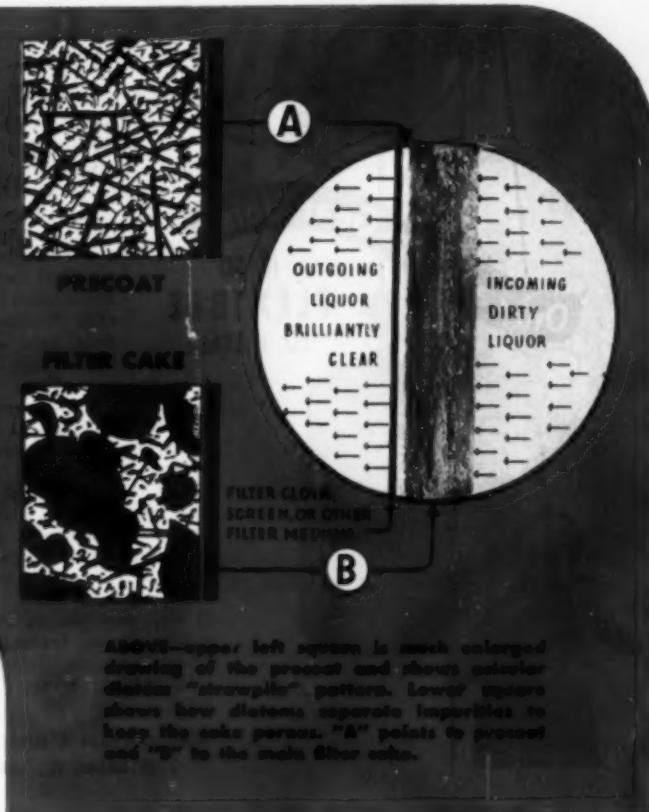
Filtration with diatomaceous filteraids is "microscopic straining" at high speed. The photograph of an actual filter cake and the diagram above picture the action.

The unique physical structure, that is, the formation of the individual diatom particles, is the basis of their efficiency.

Diatoms in Dicalite filteraids are predominantly acicular ("needle-like") or elongated types. As they build up in the filter cake, together with the suspended solids being filtered from the liquor, the diatoms interlace and overlay in a "strawpile" pattern. Millions of extremely fine openings are formed in the cake.

Thus Dicalite Filteraids build a filter cake

FOR MORE COMPLETE DATA SEND FOR FREE COPY OF BULLETIN B-10



ABOVE—upper left square is much enlarged drawing of the precoat and shows exterior diatom "strawpile" pattern. Lower square shows how diatoms separate impurities to keep the cake porous. "A" points to precoat and "B" to the main filter cake.

that not only has finer porosity ("sharper" straining action) for brilliant clarity, but has a greater number of openings for passage of greater volumes of liquor and longer filtration cycles.

Briefly, these are the reasons why Dicalite filteraids give brilliant clarity and higher flowrates, guard the quality of finished products, and help toward increased production and lower costs.

To make the most of these advantages, nine different grades of Dicalite filteraids are supplied. One or more of these will maintain quality and maximum production, whether process liquors vary or operating conditions differ from time to time in your own plant.



THE DICALITE COMPANY

CHICAGO 1, ILLINOIS • NEW YORK 5, NEW YORK • LOS ANGELES 14, CALIFORNIA

OFFICES AND WAREHOUSES IN PRINCIPAL CITIES OF U.S.A. AND IN CANADA



THE use of worm gear speed reduction in Reading Electric Hoists allows you to fit the hoist to your plant layout subject to local conditions of clearance, space available, etc. These hoists are composed of four interchangeable units—suspension unit, hoisting unit, motor unit and control unit. Under this Reading Unit Construction Plan, 144 different combinations of these units are available to give you special equipment at the low cost of standard parts.

Other advantages of this worm gear construction are: quiet operation, compact size, and low cost of maintenance because of only three moving units in the hoisting mechanism. It will pay you to investigate the money saving features of Reading Electric Hoists. For full technical information, write for Bulletin 1004.

READING CHAIN & BLOCK CORPORATION
2105 ADAMS ST., READING, PA.

CHAIN HOISTS • ELECTRIC HOISTS • OVERHEAD TRAVELING CRANES

READING HOISTS



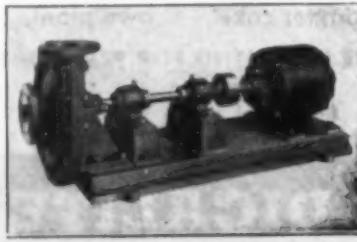
FOR HOT ACIDS

This service—one of the most severe imposed upon any pump—is being successfully rendered by LAWRENCE CENTRIFUGALS, throughout the chemical industries. Both horizontal and vertical LAWRENCE PUMPS are handling hot acids (including sulphuric acid), acid solutions, acid slurries, fruit juices, and similar corrosive fluids. The pump itself—shaft, impeller and casing—are of such resistant materials as Monel metal, stainless steel, Hastelloy, Ni-Resist, Ni-Hard, Durimet, Duraloy, Illum, etc.—determined in each case by the characteristics of the fluid pumped. And, naturally, there is no alteration in the fluid itself due to chemical reactions in the pump. Let us work with you. Write for Bulletin 203-3.

LAWRENCE MACHINE & PUMP CORP.
369 Market Street LAWRENCE, MASS.



Vertical Acid Pump Inside Tank



Acid Pump in Lead

LAWRENCE **CENTRIFUGALS**
FOR EVERY PUMPING DUTY

R. E. Sprenkle has been appointed hydraulic engineer with the Bailey Metal Co., Cleveland. In this capacity Mr. Sprenkle will act as consultant on all problems of fluid flow and will supervise research.

Leonard H. Cretcher, assistant director of Mellon Institute of Industrial Research, received the 1944 award of the Pittsburgh Section of the American Chemical Society February 15.

Ralph W. Diamond, former assistant general manager of the Consolidated Mining and Smelting Co. of Canada, has been named general manager to succeed James Buchanan, who has retired.

V. H. Baker has been named plant manager and product engineer of Elliott Co.'s Lagonda division, Springfield, Ohio. Mr. Baker has been associated with Elliott for 35 years.

Arvid E. Lyden, chemical engineering graduate of the University of Minnesota and graduate of New York University Law School, has been appointed director of the patent division of the Pennsylvania Salt Manufacturing Co. He succeeds A. E. Gibbs who has for several years served as director of the patent division in addition to his position as advisory technical director. Mr. Gibbs will continue in the latter capacity.

F. W. Breth and Gustave Schindler have been elected vice presidents of L. Sonneborn Sons, Inc. Dr. Breth who has been with Sonneborn since 1915, will be in charge of manufacturing. Mr. Schindler will continue as president of Petroleum Specialties where he has been instrumental in the market development of various petroleum derivatives.

F. T. D. Meares, mechanical plant department manager of Noyes Bros. (Sydney) has arrived in this country for discussions with a number of companies on the trading relationships in Australia.

C. H. Greenewalt has been appointed an assistant director of the Development Department of E. I. du Pont de Nemours & Co. where he will be in charge of technical activities.

W. B. Holton, Jr. president of the Walthworth Co., has been elected president of The Valve Manufacturers Association.

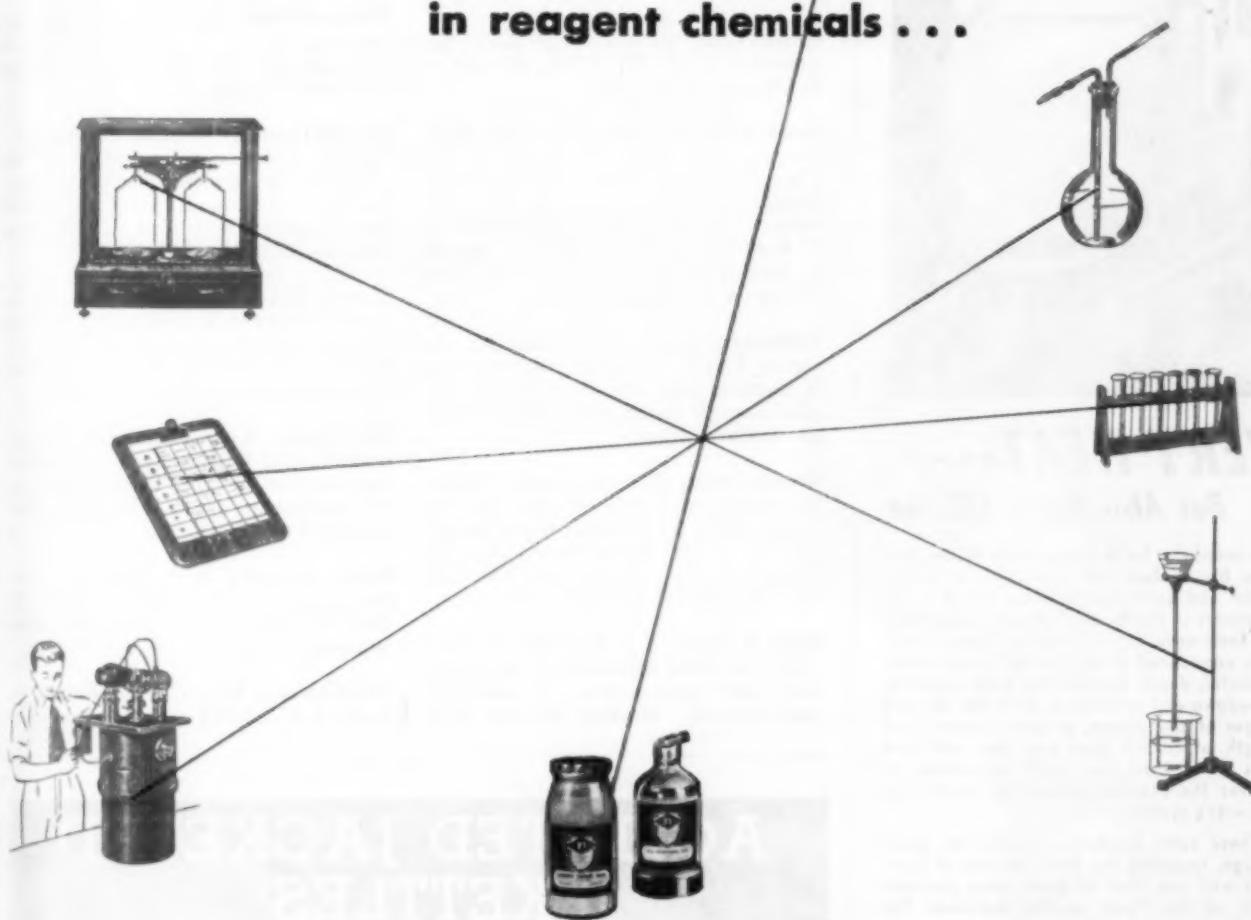
OBITUARIES

H. R. Smalley, 57, nationally known soil scientist, and director of Soil Improvement Work and member of the Staff of The National Fertilizer Association for over 25 years, died February 27 in Washington, D. C., following four week's illness.

James Lincoln Ashley, 75, a director of The International Nickel Co. of Canada, died suddenly March 6.

Stephen P. Burke, 47, professor of chemical engineering at Columbia University, died in New York March 10.

The only way to measure **QUALITY**
in reagent chemicals . . .



Set rigid specifications and strict limits on impurities for product after product; then make these your inflexible standards for lot after lot—and you have the *true measure of quality for laboratory reagents*.

Exacting . . . difficult to achieve, particularly under present conditions? Yes, but this is the measure of quality by which Baker & Adamson produces all its reagent chemicals to assure their consistently

dependable performance in your laboratory . . .

And B & A continues to establish new, higher standards of chemical quality—to set closer tolerances on impurities—even during today's trying times.

With good reason, then, Baker & Adamson quality has earned the confidence of chemists everywhere. That's why so many chemists always specify B&A to be sure of getting the full measure of reagent chemical quality.



Setting the Pace in Chemical Purity Since 1882

BAKER & ADAMSON

Division of GENERAL CHEMICAL COMPANY, 40 Rector St., New York 6, N. Y.

Sales and Technical Service Offices: Atlanta • Baltimore • Boston • Bridgeport (Conn.) • Buffalo
Charlotte (N. C.) • Chicago • Cleveland • Dallas • Detroit • Houston • Kansas City • Los Angeles
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Seattle • St. Louis • Tulsa (Okla.) • Waukesha • Yakima (Wash.)

as distributor for The Nichols Chemical Company, United • Ammonium • Potash • Vanadium

Reagent
and Fine
Chemicals

INDUSTRIAL NOTES



VERY NEAT--- But Also Highly Efficient

The men who build Layne Well Water Systems like to turn out a neat job of pump, motor and control installation. But it is the engineers in the factory who are responsible for their extra high over-all efficiency. First, they considered all of the well conditions—diameter, depth, static water level, capacity, drawdown and total head. Then the size and stages of the pumps, proper diameter and length of column pipe and line shaft and thus determined the right horsepower to deliver the required amount of water into the user's system.

These same engineers created the pump design, specified the kind and size of bearings and saw that all parts were precision built of the finest quality materials. The result is a highly efficient, complete water system that will pay extra dividends in long life, low operation cost and freedom from mechanical faults.

Layne installed wells and Layne vertical turbine pumps are fully recognized by the most eminent engineers as being the finest in quality and the most efficient ever built.

If you need more, either from additional wells, or from reconditioned old wells, write for further details. Address LAYNE & BOWLER, INC., General Offices Memphis 8, Tenn.

LAYNE PUMPS—fulfill every need for producing large quantities of water at low cost from wells, streams, mines or reservoirs. Send for literature.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Cincinnati, Ohio. * Layne-Louisiana Co., Lake Charles, La. * Layne-Well Co., Monroe, La. * Layne-New York Co., New York City. * Layne-Northwest Co., Milwaukee, Wis. * Layne-Pacific Co., Sacramento, Calif. * Layne-Texas Co., Houston, Texas. * Layne-Western Co., Kansas City, Mo. * Layne-Western Co., of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada



**WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS**

Arnold-Hoffman Co., Providence, has added B. F. Sheehan, Jr. to its sales staff. Mr. Sheehan will make his headquarters in the Empire State Bldg., New York.

General Controls Co., Glendale, Calif., has appointed Joseph W. Wilson manager of its Glendale branch office.

Standard Oil Co., New York, announces that Lt. Col. John E. Devine of the Chemical Warfare Service has rejoined the company as sales manager for the mid-western territory with headquarters at 75 East Wacker Drive, Chicago. Joseph F. Harrington has been transferred from Chicago to the New York office.

Philadelphia Quartz Co., Philadelphia, has elected Edwin A. Russell vice president in charge of sales. He also is director and sales manager of an associated company, the American Doucile Co.

Owens-Corning Fiberglas Corp., Toledo, has transferred Ben S. Wright from the general offices to Cleveland where he will serve as manager of the branch office. He succeeds W. H. Atkinson who now manages the office in Chicago.

Jones & Yoder, 110 East 42d St., New York, has been organized as engineering and sales representatives of machinery manufacturers. Heading the new enter-

prise are Joseph C. Jones and Leonard A. Yoder. Offices are also maintained in Cleveland and Philadelphia.

Pittsburgh Plate Glass Co., Pittsburgh, has appointed Walter T. Johnson as district sales manager for the Columbia Chemical Division in Chicago.

Marietta-Harmon Chemicals, Inc., Marietta, Ohio, is a new concern formed by the merger of the Harmon Color Works, Inc., Haledon, N. J., and Marietta Dyestuffs Co., Marietta. Both were subsidiaries of American Home Products Corp.

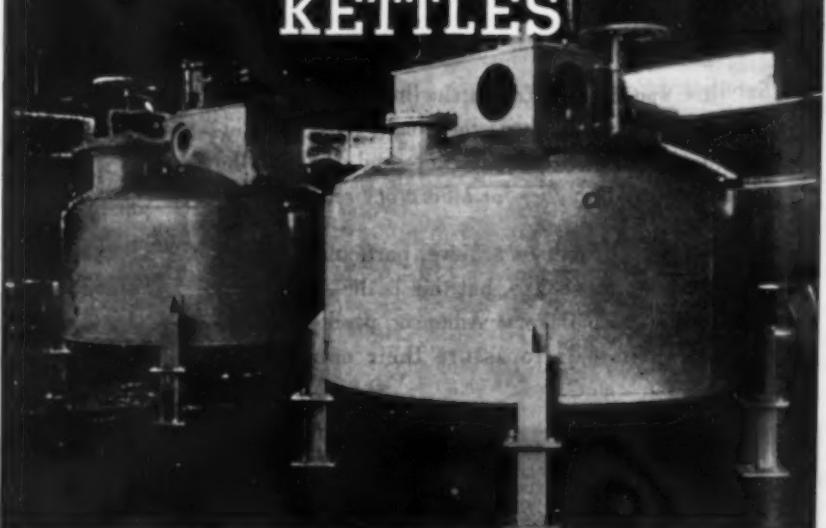
Carnegie-Illinois Steel Corp., Chicago, has advanced George A. Fort to the position of plant industrial engineer at Gary, Ind. Milton L. Weislogel succeeds him as assistant plant industrial engineer.

The Girdler Corp., Louisville, has appointed Boyd R. Hopkins as east central representative for the Thermex division. His headquarters are at 1836 Euclid Ave., Cleveland.

Resin Industries, Santa Barbara, Calif., has opened a branch office at 3902 W. Sixth St., Los Angeles. Perry Goodspeed is manager of the new office.

Allis-Chalmers Mfg. Co., Milwaukee, has made A. J. Schmitz regional manager for

AGITATED JACKETED KETTLES



**LEADER BUILDS
TANKS — KETTLES — FRACTIONATING COLUMNS
HEAT EXCHANGERS and SPECIAL EQUIPMENT**

**OF
STEEL — STAINLESS STEEL — NICKEL — MONEL
INCONEL — COPPER — EVERDUR — HERCULOID
HASTELLOY — ALUMINUM and CLAD STEELS**

LEADER IRON WORKS, INC.

2200 N. JASPER

DECATUR, ILLINOIS

THE JUDGMENT OF LEADERS IS ALWAYS SIGNIFICANT

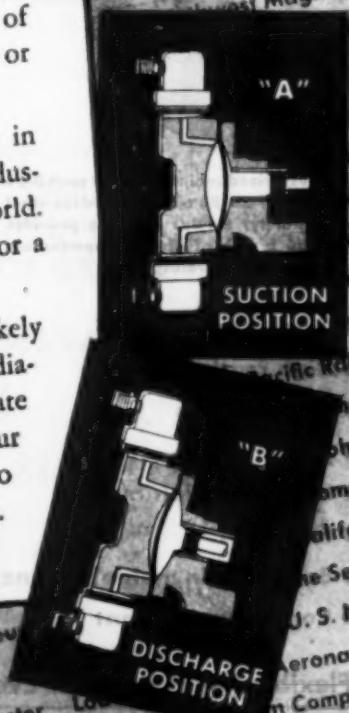


The judgment of leadership, in what seems to be dominating percentage, is that WILSON Pulsafeeders (chemical proportioning pumps), are outstanding for handling metered flows of liquids, in large and small production.

Kind and quantity are seldom a limiting factor, because WILSON Pulsafeeders handle chemicals of high or low viscosity, acids and volatiles, as well as slurries. In most instances, accuracy is guaranteed at better than $\frac{1}{8}$ of 1%, and capacity may range from 1 cph. to 600 gph. or more. Flow may be mono or multiple.

Today, WILSON Pulsafeeders are serving magnificently in chemical laboratories, in food and other processing industries, and in water and sewage treatment all over the world. They operate on automatic settings, manual control, or a combination of both.

They are amazingly dependable. They have no leak-prone packing glands, and they have those patented, flexible dia-phragms which operate against an inert liquid to obviate breakage. (See sketches) and then send for details of our cooperation in engineering WILSON Pulsafeeders to your requirements. We always welcome inquiries.



WILSON CHEMICAL FEEDERS, Inc.

207 CLINTON STREET (P. O. Box 998) BUFFALO 4, N. Y.
Est. 1923...WITH EXPERIENCE IN ALLIED LINES SINCE 1914

26 NOSES



The pressurized cabin ducting of each B-29 consists of 26 Rex-Flex stainless-steel units. Safely, surely, Rex-Flex provides the very breath of life for Superfortress crews in the substratosphere.

- Non-collapsible
- High crush strength
- Low line loss
- Airtight
- High vibration quality
- Fireproof
- Bendable in multiple planes
- Corrosion resistant

Flexible Metal Hose for Every Industrial Use



CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

Industry has found many ways to profit from these extra Rex-Flex qualities—manufacturers have learned how to save time and money with this modern stainless-steel tubing. Let us show you how Rex-Flex can help in combating heat, corrosion or vibration in your products of today and tomorrow. Write now for complete information.

the Pacific Coast with headquarters in San Francisco. He is succeeded as manager at Seattle, Wash., by U. E. Sandelin.

Homestead Valve Mfg. Co., Coraopolis, Pa., has started operations at its new plant at Edgeworth across the river from its main plant.

R. W. Greeff & Co., New York, announces that J. M. Selden who has been secretary of the company for several years, has been elected vice president.

Paisley Products, Inc., New York, is now represented in western New York by A. R. Nordone, 423 Eggert Road, Buffalo.

The Dicalite Co., New York, has appointed G. A. Russell as central division manager with headquarters in Chicago. H. L. Dunham has been made eastern division manager and is located in the New York office.

Thomas Machine Mfg. Co., Pittsburgh, has appointed sales agencies in 16 major cities to handle Thomas equipment east of the Mississippi. Similar agencies will be appointed for the western territory.

American Chain & Cable Co., Inc., Bridgeport, has advanced Alton Parker Hall to the position of general manager of sales with headquarters at 230 Park Ave., New York.

American Machine and Metals, Inc., East Moline, Ill., has established new district offices at Dallas, Minneapolis, and Philadelphia. Oliver H. Castle is manager at Dallas, G. W. Johnson at Minneapolis, and Harold N. Ewertz at Philadelphia.

Trent Tube Mfg. Co., East Troy, Wis., announces that Frank G. Folke has joined the company in the capacity of general manager.

The Cooper-Bessemer Corp., Mount Vernon, Ohio, has added Walter F. Myers to its Washington staff where he will assist Charles G. Cooper in the handling and supervision of government contracts and sales and service in southern Atlantic states.

Continental Can Co., New York, has appointed H. P. Thelen manager of steel container sales. He formerly was manager of the steel container division of Owens Illinois Can Co.

Wickwire Spencer Steel Co., New York, has placed Henry Davis in charge of its newly formed market research department.

U. S. Industrial Chemicals, Inc., New York, has made Dr. Harry J. Prelubitsky manager of special products sales. Robert K. Rigger formerly of the technical development laboratory of the company will be his assistant.

Lukens Steel Co., Coatesville, Pa., has named Edward J. Charlton as manager of development engineering for the company and its subsidiaries.

ADVA
TYPE C
• Prelub
cation
• Improv
• Dynami
• Dia-tos
• Liberal
leaves a
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PLANTS
CHEM

PRELUBRICATED SEALED BALL BEARINGS...NOW STANDARD ON TYPE CSP MOTORS UP TO 3 HP

Bought now, Westinghouse Type CSP Prelubricated Motors need no greasing till 1950! Extensively field tested in thousands of textile motor applications, the prelubricated ball bearings in Westinghouse Type CSP general-purpose motors have proved they can operate five years . . . 24 hours a day . . . without greasing. Overgreasing and consequent grease seepage into windings is eliminated. One of the major items of induction motor maintenance, periodic greasing, has been reduced to one grease packing job in five years.

Every Westinghouse Type CSP Motor up to 3 hp carries the "Prelubricated" label. For complete information on how the Type CSP Motor can reduce your maintenance, write for D.B. 3100-CSP. Westinghouse Electric & Manufacturing Co., P.O. Box 868, Pittsburgh 30, Pa.

J-21317

FORGET LUBRICATION... *till 1950!*



ADVANTAGES OF WESTINGHOUSE TYPE CSP PRELUBRICATED MOTORS

- Prelubricated Sealed Ball Bearings reduce lubrication maintenance . . . assure longer grease life
- Improved Tuffnoll Insulation
- Dynamically Balanced Rotor
- Die-cast Rotor with oversize fan
- Liberal Through-ventilation—air enters front, leaves at drive end of motor

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



Type CSP Motors

26 NOSES



FOR THE LUNGS OF A B-29

The Bell-fabricated B-29 is the most dangerous type of bomber in the air—but only for our enemies. Safety of the men that fly Superforts comes first in Bell's huge Georgia plant . . . every single part that goes into the B-29—regardless of size—is the finest to be had. That's why Rex-Flex stainless-steel ducting was chosen for all B-29 pressurized cabins.

Rex-Flex is *dependable*. Above 30,000 feet—where unbalanced pressures would take a crushing toll of other materials—this stainless-steel life line is non-collapsible. Rex-Flex not only has maximum durability but is the most leakproof and fireproof ducting suitable for aircraft use. And even installation is better because Rex-Flex is manually bendable in multiple planes. At left are some of the reasons Rex-Flex is the flexible tubing for *your* job:

The pressurized cabin ducting of each B-29 consists of 26 Rex-Flex stainless-steel units. Safety, surely, Rex-Flex provides the very breath of life for Superfortress crews in the stratosphere.

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- Airtight
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- Fireproof
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Plants: Maywood and Elgin, Ill.

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the Pacific Coast with headquarters in San Francisco. He is succeeded as manager at Seattle, Wash., by U. E. Sandelin.

Homestead Valve Mfg. Co., Coraopolis, Pa., has started operations at its new plant at Edgeworth across the river from its main plant.

R. W. Greeff & Co., New York, announces that J. M. Selden who has been secretary of the company for several years, has been elected vice president.

Paisley Products, Inc., New York, is now represented in western New York by A. R. Nordone, 423 Eggert Road, Buffalo.

The Dicalite Co., New York, has appointed G. A. Russell as central division manager with headquarters in Chicago. H. L. Dunham has been made eastern division manager and is located in the New York office.

Thomas Machine Mfg. Co., Pittsburgh, has appointed sales agencies in 16 major cities to handle Thomas equipment east of the Mississippi. Similar agencies will be appointed for the western territory.

American Chain & Cable Co., Inc., Bridgeport, has advanced Alton Parker Hall to the position of general manager of sales with headquarters at 230 Park Ave., New York.

American Machine and Metals, Inc., East Moline, Ill., has established new district offices at Dallas, Minneapolis, and Philadelphia. Oliver H. Castle is manager at Dallas. G. W. Johnson at Minneapolis, and Harold N. Ewertz at Philadelphia.

Trent Tube Mfg. Co., East Troy, Wis., announces that Frank G. Folke has joined the company in the capacity of general manager.

The Cooper-Bessemer Corp., Mount Vernon, Ohio, has added Walter F. Myers to its Washington staff where he will assist Charles G. Cooper in the handling and supervision of government contracts and sales and service in southern Atlantic states.

Continental Can Co., New York, has appointed H. P. Thelen manager of steel container sales. He formerly was manager of the steel container division of Owens-Illinois Can Co.

Wickwire Spencer Steel Co., New York, has placed Henry Davis in charge of its newly formed market research department.

U. S. Industrial Chemicals, Inc., New York, has made Dr. Harry J. Preblud manager of special products sales. Robert K. Rigger formerly of the technical development laboratory of the company will be his assistant.

Lukens Steel Co., Coatesville, Pa., has named Edward J. Charlton as manager of development engineering for the company and its subsidiaries.

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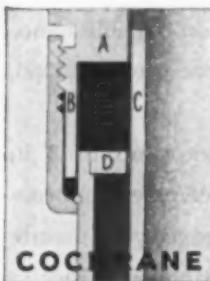


Fig. 1

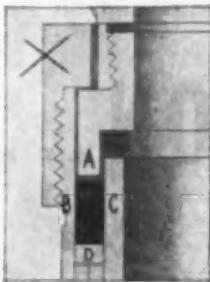


Fig. 2

Above are shown two rotameter stuffing boxes. As the fitting is screwed tight on both, pressure is exerted at A. In both, this packing is solidly backed at D, so pressure is even on areas B and C, which are, in effect, long cylindrical seals. In both, leakage is safeguarded along C, but in the ordinary rotameter (Fig. 2), when fluid gets past A, it is bound to leak because B is in no way effective. Now examine Cochrane's leak-proof construction (Fig. 1). It cannot leak, because fluid getting past A would have to traverse entire surface of sealing face B to get out. Cochrane's is a real stuffing box.

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ROTAMETERS

CONVENTION PAPER ABSTRACTS

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The South has great resources in material power, men and intelligence. It has been starved by industry for many years but by intelligent direction it will grow fat.

The predicted expansion can be fostered all business throughout the South should take a positive hand in inducing profitable industry to locate there. Cheap outfitts who look to the South merely as a source of cheap labor are not wanted; cheap labor in the end is economically unsound. The types of industry most ardently to be desired are the long profit industries; chemical manufacturing, pharmaceutical manufacturing, plastic manufacturing, food specialty manufacturing and industries of like nature which develop products for consumer sale.

Francis S. Chilson, Industrial Consultant, before Chattanooga branch, American Chemical Society, Jan. 16, 1945.

TOXICITY OF DDT

IN GENERAL the ingestion of DDT shows that doses at about the level of 300 mg per kg. are lethal to most animals. Of course, three grains would never be taken by a 220-lb. man, but it is not so much the lethal dose that must be considered as the type of toxicological effect the substance has upon red blooded animals. In general, degeneration of the liver occurs when DDT is absorbed in the system. It may be absorbed through the skin if a suitable solvent is present. Some of the results are on applications of a 5 percent

THE SOUTH POSTWAR

THERE is no doubt that the South is in the process of awakening from the lethargy imposed by conditions following the Civil War. The immediate postwar years will see a tremendous development in the chemical industry all through the South, but particularly in the watershed served by TVA.

Actually the process has already begun, and in spite of the fact that the war has already brought tremendous industrial development, the boom is only beginning.

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solution in dimethyl phthalate to the skin. Vegetable oils render the chemical more absorptive than when in the dry state. It must be said at this stage of our knowledge that the use of the dry powder on the skin, such as were the applications at Naples and the applications used by our troops with the present formula of lousepowder, shows no toxicity of any kind, and it is probable that DDT may be used in the dry powdered form on red blooded animals for the destruction of lice, ticks, etc., without harm coming to the animals.

The difficulty in such work lies in the quantitative determination of the amount of liver damage incurred by the test animals exposed to a suitable number of repeated atmospheres of a DDT aerosol over a long period of time and the establishment of a level at which DDT can be used and rejected by the liver without causing any damage whatsoever to the organ. The ultimate decision must be a very considered one based on a huge mass of experimental evidence, for if the decision should be erroneous, then the human race will be the loser.

Even if it should be proved that DDT may not safely be used by the general public in the aerosol form, there is no doubt it will be used extensively by professional exterminators equipped with masks of some kind to free it from the air they breathe. It will give them a handy and quick method of eliminating undesirable insects from houses and turning the rooms back to service in a short space of time. It apparently has some advantages over hydrocyanic acid gas for this purpose. If it is found that DDT has no effect on plant life, it may be used in greenhouses, in the fields, and in orchards. Already experiments have shown that it is most effective against gypsy moths and has been used in aerosol form with fine results against the pea aphid. Everyone looks forward to the extension of this knowledge.

W. W. Rhodes, Kinetic Chemicals, Inc., before Canadian Section, Compressed Gas Manufacturers' Association, Lucerne, Que., Oct. 10-11, 1944.

PROTECTING RESEARCH PROFITS

There are three outstanding facts as to the American patent system upon which we depend; and upon which this country has depended for more than a century. First, the patent system of rewards has made the United States the predominant industrial nation of the world. Second, this war is now being won primarily due to our ingenuity in invention, research, science and manufacturing in the United States. Third, the American system has been under continuous attack by governmental theorists attempting to destroy it and to destroy with it independent research at the same time.

The subject of invention and patents to establish the rights to inventions has always been a controversial one. Politically, the right to intellectual creations and new developments has been at the very heart of the movements that have led to the growth of the American nation. In dealing with research and invention, we are dealing with the very warp and woof of the fabric of American life. It is likewise equally axiomatic that all of our great industries have, at one time or another, or

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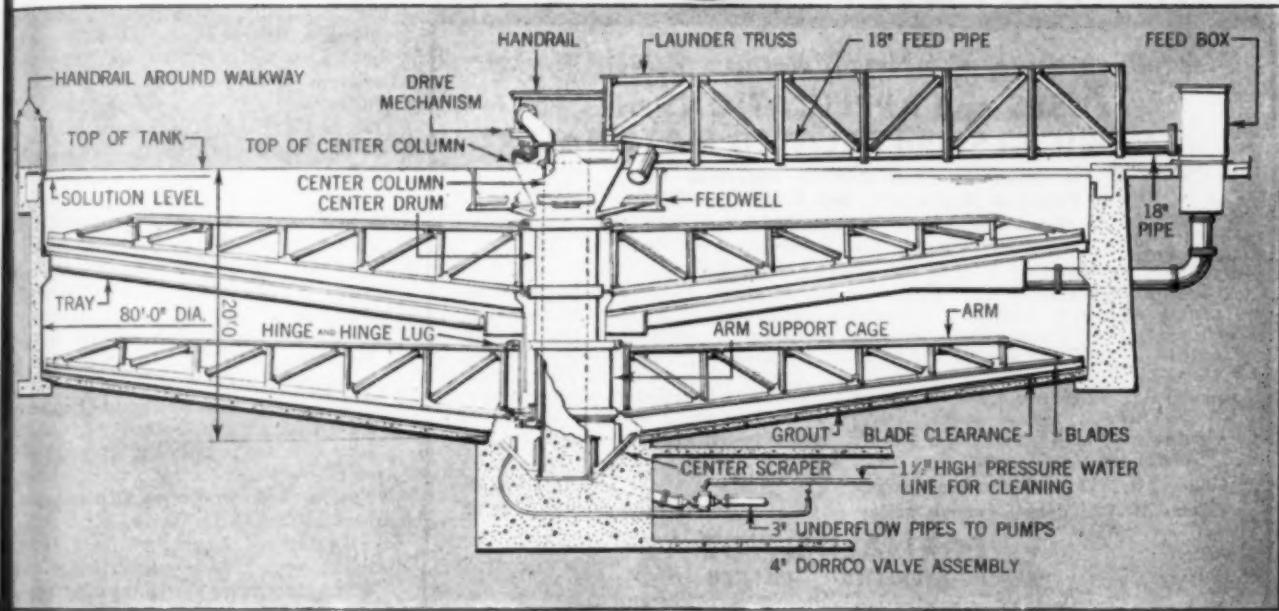
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HERE'S an end to stalls and breakage from thickener overloads! The Dorr Torq Balanced Tray Thickener with its unique features takes tray obstructions in its stride.

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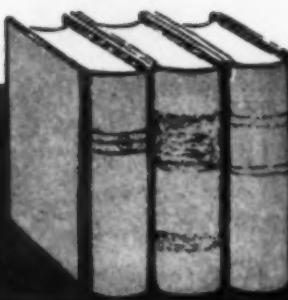
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continuously, been founded upon patent. The same thing has been true of the other great industrial nations of the earth. Indeed, the prosperity of most of the nations of the earth has been reflected by the number of patents taken out by their citizens.

Patents are of interest because they provide the means of establishment of claim to scientific achievement. They present the opportunity to use them for the furtherance of research and to throw those results open to the public through patents, preventing others from securing patents on the same subject for exclusive commercial gain. They are useful for rewarding young research workers, and useful for financing further research. They are particularly useful in the control of inventions for the public benefit, so that they can only be produced by responsible manufacturers.

The number of patent suits that are brought are infinitesimal compared to the number of patents that are recognized as good and valid by competition in the trade. The fact that the courts defeat a large proportion of the patents upon which litigation is brought only indicates this fact. Reformers would have us believe that the invention quality is going down in the United States, that the Patent Office makes grave errors in allowing patents, that there are too many patents and that the whole patent system is due for a thorough house cleaning. Men who make such assumptions have no knowledge of the actual facts.

Undisputed facts confront critics and refute their unsupported charges based upon generalities and discontent.

No system is perfect. No patent system is perfect. All people will never be satisfied with any governmental system. It is human nature for failures to blame everybody else and every government system except themselves.

When the patent system is confined to its legitimate and normal function it yields rich dividends in money, in stable business, in full employment and in substantial honors and awards for the fortunate inventors.

H. A. Toumlin, Jr., Toumlin & Toumlin before the Staff of the Battelle Memorial Institute, Columbus, Feb. 3, 1945.

PETROLEUM NOW AND POSTWAR

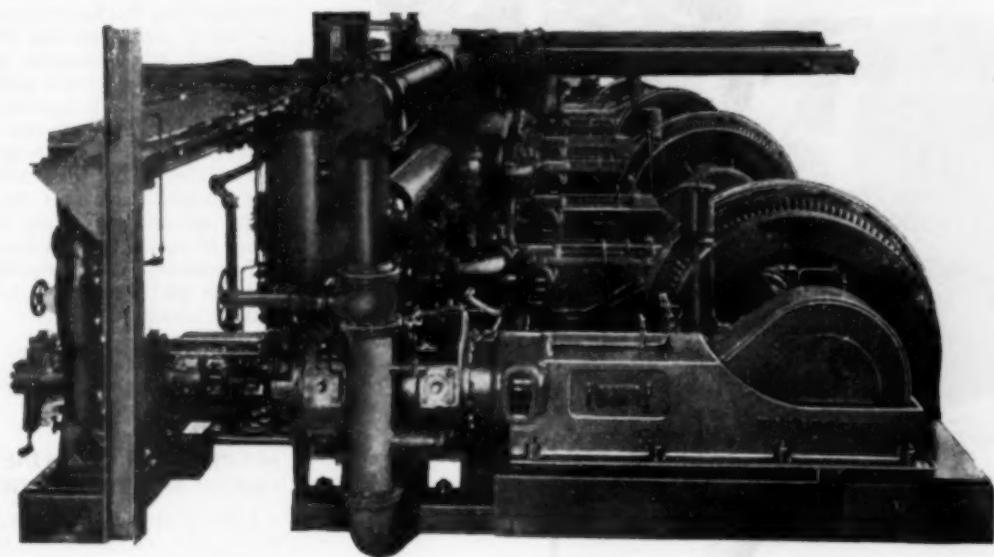
THE UNITED STATES military demand for gasoline reached 34,000,000 gal. daily in 1944, an increase of 433 percent in the three years since Pearl Harbor.

Combined military and civilian demand has reached 84,000,000 gal. daily, despite the fact that civilian use is strictly controlled. But, of course, the essential work of the country must go on; and gasoline being the prime source of mobile energy, its consumption even in wartime necessarily remains high.

Also, crude-oil production has increased 20 percent in the United States since 1943—and this in spite of lack of materials, serious shortage of manpower, a frozen price structure, and other handicaps. For the first 9 mo. of 1944, the industry turned to refineries 18 percent more crude oil than it did in the same period of 1943.

Nearly 600 million gal. of gasoline and oil are going overseas each month to our fighting forces, necessitating an average of 156 tanker sailings per month.

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That's why you'll find the Worthington organization well equipped with engineers and machines to treat your case individually... study your project in the light of its peculiarities... and design for you the CO₂ plant you need to strike the right balance between first cost and operating cost.

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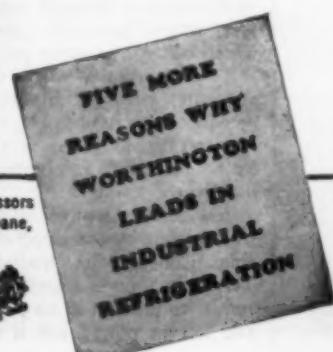
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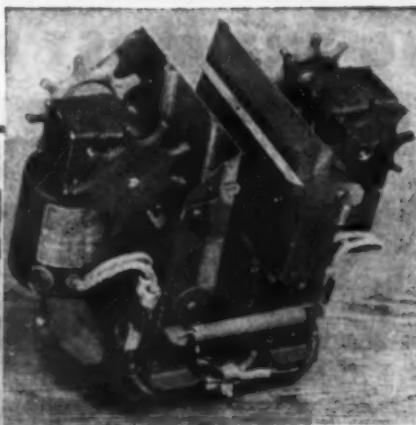
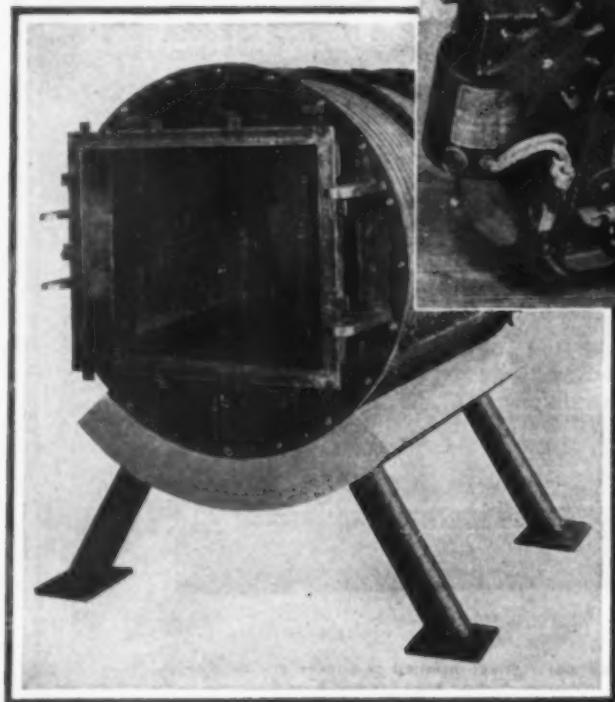


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Ammunition Booster
to feed belted ammunition to machine guns on Martin airplanes. Built of stainless steel by Brandt of Baltimore.

3,800 lb. Electro-Processing Oven, fabricated by Brandt for a cork board plant.

These Fabrication Facilities May Fit Your Postwar Plans

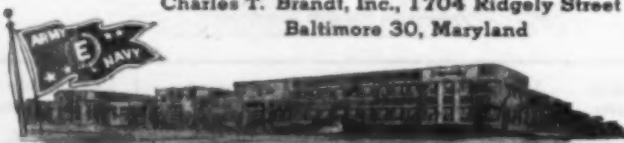
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And if you've hit a snag on your postwar product, our designers and engineers will welcome the opportunity to assist in planning the details and specifications. Naturally, all plans will be held in strict confidence. So if there are fabrication or design problems in your postwar plans, we invite you to discuss them with—

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The industry and our state conservation agencies and IOCC all are going to have to give the conservation of crude oil and natural gas the benefit of careful study as soon as the war is over. And that doesn't mean that we are about to run out of oil, or that we are in any danger of running out of oil. We have tremendous known reserves of petroleum, and others will be discovered. But the great and growing importance of petroleum products in our national life makes it imperative that none be squandered. For both security and economic reasons, we want to get all the oil out of the ground that will come out. The amazing discoveries that are being made, almost daily, about the potential values of natural gas as a source of energy and chemicals make it equally imperative that this gas be used, also, to the greatest possible advantage of all.

W. R. Boyd, Jr., president, API, before winter quarterly meeting, Interstate Oil Compact Commission, Jackson, Miss., Dec. 16, 1944.

SULPHATE TURPENTINE AS A CHEMICAL RAW MATERIAL

CRUDE sulphate turpentine, a byproduct of the sulphate process for making paper pulp, has been increasingly used in recent years as a source of pinene for chemical synthesis. This crude sulphate turpentine varies widely in its composition. Locality, type of soil, age and variety of pine trees, and variations in the pulpmaking process all affect it. Average analyses would be about as follows:

Alpha-pinene	50-60%
Beta-pinene	15-20%
Monocyclic terpene hydrocarbons	10-15%
Sulphur compounds and impurities	10-15%

Pinene may be isomerized by appropriate catalytic means into camphene. This, in turn, is converted into a complex thiocyanacetate derivative sold under the trade name of Thanite which is one of the most powerful and generally effective insecticides known.

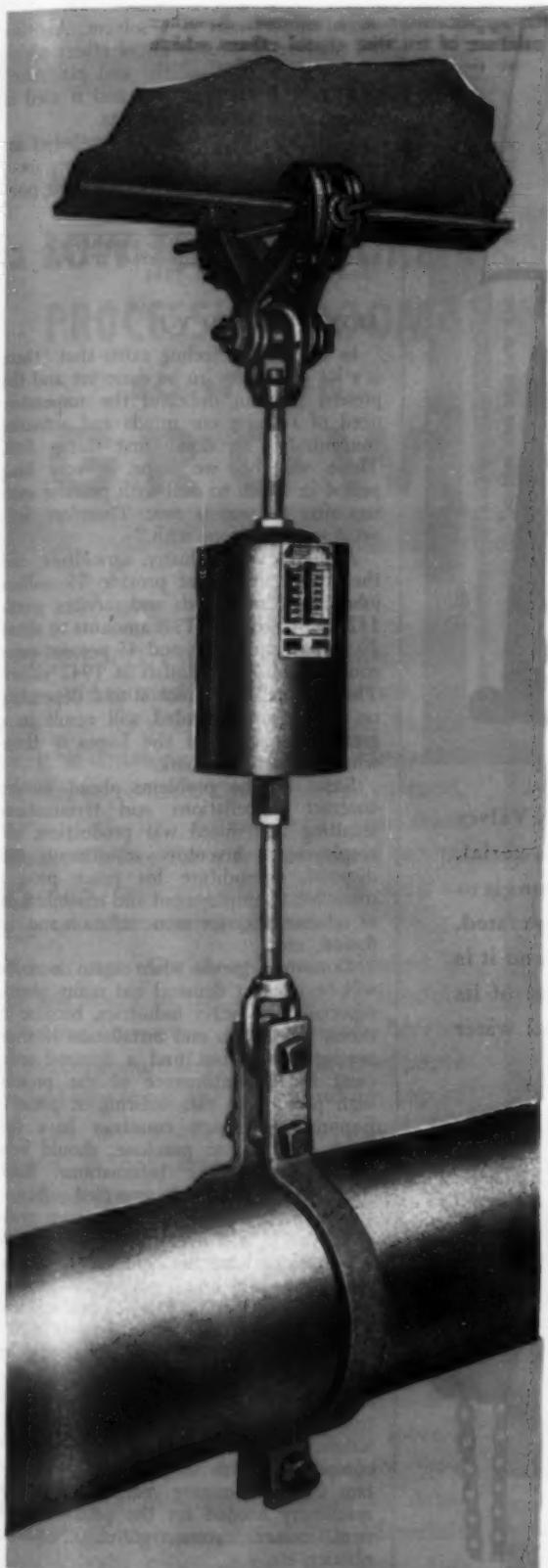
Another form of catalytic isomerization of pinene yields a mixture of monocyclic terpene hydrocarbons. From this material valuable solvents for paint and enamel formulation and for rubber reclaiming compounds are produced.

Pinene is hydrated to produce synthetic pine oil. Like its natural prototype, synthetic pine oil consists largely of terpineol, together with some secondary alcohols, principally isoborneol. It has essentially the same industrial uses as natural pine oil.

Pinene may be further hydrated to terpin hydrate. This crystalline product, white and practically odorless, has long been used in medicine as a cough remedy. In recent years several industrial uses have appeared which call for quantity production.

Terpin hydrate, when dehydrated catalytically, yields a mixture of terpineols in which beta-terpineol is the predominating constituent. This is the commercial Prime Terpineol, a delicate perfume of the lilac type.

A wide variety of ethers can be prepared from pinene by the direct addition of suitable alcohols. The products are sold as Terposols. One is a methyl ether which is similar to pine oil in its physical properties and solvent power, but it also has certain



Save Engineering Time

WITH GRINNELL Pre-Engineered SPRING HANGERS

1. Compute the load
2. Select the required stock size

When spring hangers for modern flexibly supported piping systems are "tailor-made" for each load condition, a lot of scarce engineering and drafting man-hours are required in designing. The Grinnell Spring Hanger will save this time - it is "pre-engineered for the job." The capacity you need is conveniently "packaged" - one of 14 stock sizes.

**12½% MAXIMUM CHANGE IN SUPPORTING FORCE
OF SPRING IN $\frac{1}{2}$ " VERTICAL TRAVEL--IN ALL SIZES**

**GUIDES PREVENT CONTACT OF COILS WITH CASING
WALL OR HANGER ROD AND ASSURE CONTINUOUS
ALIGNMENT AND CONCENTRIC LOADING OF SPRING**

COMPACT—REQUIRES MINIMUM HEADROOM

**ALL-STEEL WELDED CONSTRUCTION MEETS
PRESSURE PIPING CODE**

**14 SIZES AVAILABLE FROM STOCK--LOAD RANGE
FROM 84 LBS. TO 4700 LBS.**

**EASY SELECTION OF PROPER SIZES FROM SIMPLE
CAPACITY TABLE**

**INSTALLATION IS SIMPLIFIED BY INTEGRAL LOAD
SCALE AND TRAVEL INDICATORS**

**UNIQUE SWIVEL COUPLING PROVIDES ADJUSTMENT
AND ELIMINATES TURNBUCKLE**

*Write for descriptive folder on Fig. 268
Pre-Engineered Spring Hangers.*

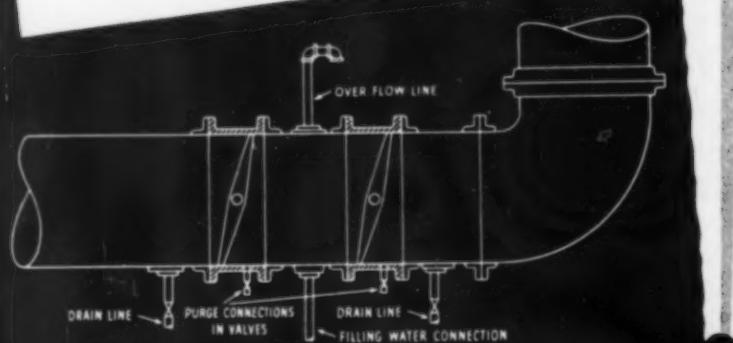
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GRINNELL
WHENEVER PIPING IS INVOLVED

How to Seal A Gas Line



When the gas is to be shut off, the two 25-pound R-S Butterfly Valves are closed and the space between filled with water or other material, thus forming a tight seal. The purpose of the purge connections is to flush sediment from the shaft and vane before the valves are operated.

The sealing of gas lines is now required in many plants and it is advantageous to adapt the method sketched above because of its efficiency, low cost (costs much less than the conventional water valve) and the fact that it requires no space in the line.

Since the center of the line illustrated in the sketch is 16 feet above the floor level, the valves are chain wheel operated.

Write for Catalog No. 14-B. It contains detailed specifications (15 to 900 psi), and short cuts to simplified control and wedge type shut off of volume and pressure.



15 to 900 psi, elevated and sub-zero temperatures, for air, gas, steam, liquids and semi-solids.

VALVE DIVISION

R-S PRODUCTS CORPORATION
4523 Germantown Ave. • Philadelphia 44, Pa.

R-S
Streamlined
BUTTERFLY VALVES

special applications as a solvent. Another is a mixture of terpene glycol ethers which is a very powerful solvent and plasticizer. It is relatively high boiling and is used in several manufactured products.

These examples of pinene synthetics are all produced commercially. Many more have been developed and are awaiting postwar introduction.

S. G. Norton, Hercules Powder Co., before Byproducts Committee, TAPPI, Savannah, Oct. 18-19, 1944.

AFTER V-E AND V-J

IN ENGLAND a feeling exists that "there is a lot of fighting to be done yet and the present position indicates the imperative need of keeping our minds and activities concentrated on doing first things first. There will be, we hope, a very long period in which to deal with postwar matters after the war is over. Therefore, let's get it over and done with."

After the war, industry, agriculture, and the government must provide 55 million jobs to produce goods and services worth 142 million dollars. This amounts to about 20 percent more jobs and 45 percent more goods expressed in dollars at 1942 values. This is a mark to shoot at and depending on the effort expended will result in a greater realization of the hopes of those who have set this mark.

Some of the problems ahead involve contract cancellations and termination resulting in reduced war production, unemployment, inventory adjustments and disposal, expenditure for peace products, materials, re-employment and rehabilitation of returning service men, inflation and deflation, etc.

Consumer goods when again available will be in great demand but many plants, especially the heavy industries, because of excess production and installation of their products, may not find a demand sufficient for a continuance of the present high production rate existing at present. Exports, if foreign countries have the funds available to purchase, should help the situation. The International Bank should be of great help provided sufficient and proper credit facilities are made available. Also U. S. Government rehabilitation efforts, lend-lease if continued, government, state and municipal works and new products and industry developments will all contribute.

Large demands for products should be anticipated by suppliers of clothing, shoes, automobiles, household appliances, electronics, television and radio, building materials, railroad rolling stock and track equipment, needs of public utilities, certain types of mining machinery, process machinery needed for the production of sand, cement, stone, gravel, chemicals, plastics, etc.

All possible consideration which time permits, without interfering with the war effort, should be devoted to: (1) Analysis of products, their design and the addition of new products; (2) analysis of markets, the planning of sales and advertising programs; (3) survey of production facilities; (4) personnel problems, including number of employees, relations with labor and labor unions, etc., and; (5) finance.

As soon as the first buyers' rush is over,

How to build a LOW-TEMPERATURE PROCESSING ROOM so it can GROW

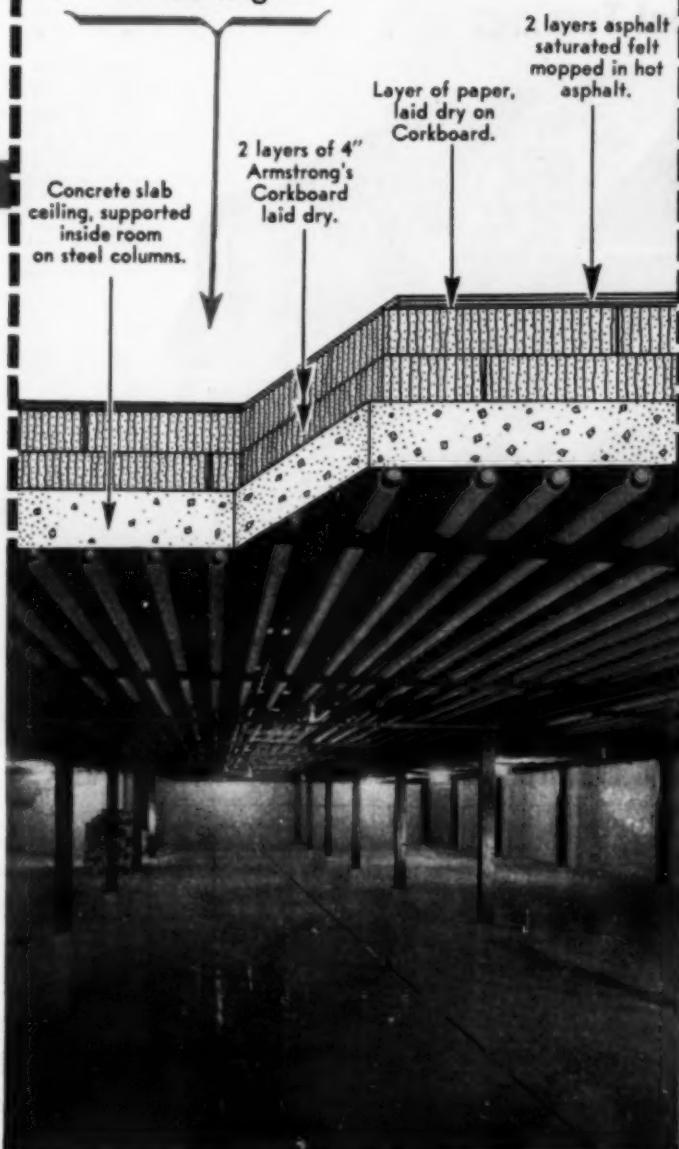
FREQUENTLY it is possible—when building refrigerated space—to foresee the future need for even larger facilities. In this case, it is desirable to install the insulation so it can be re-used. One practical method, worked out by Armstrong's Insulation Contract Service for a freezer room, can be adapted to many refrigerated areas such as are found in processing plants.

Armstrong's Corkboard was installed in floor and walls in hot asphalt. To insulate the ceiling, however, the Contract Service laid the corkboard dry. Then a layer of paper was laid dry over the cork, and on top of that two layers of asphalt-saturated felt mopped in hot asphalt. The felts were flashed up the walls to form an airtight seal above the cork. When the upper floor is converted into a second freezer, the felt and paper will be stripped off and the corkboard removed and re-installed according to standard specifications.

Perhaps Armstrong's Corkboard—and Armstrong's Contract Service—can solve a special low-temperature problem for you. For complete information, write to Armstrong Cork Company, Building Materials Division, 3303 Concord St., Lancaster, Pa.

FUTURE FREEZER SPACE (Floor Above)

Construction of Ceiling



Badger Cold Storage Co. of Milwaukee, Wis., recently completed this freezer room to operate at 20° below zero. The ceiling is so constructed that when additional freezer space is put into service directly above, all cork in the ceiling can be removed and used in new construction.

ARMSTRONG CORK COMPANY

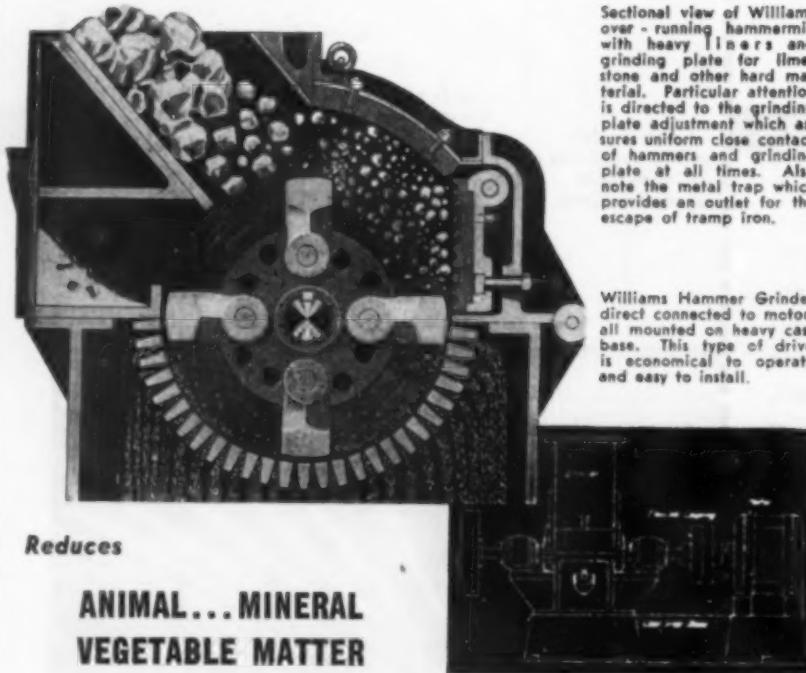
Complete Insulation  Contract Service for

All Temperatures, from 300° below zero to 2600°F.

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FOR INDUSTRIAL USE . . . Grind Chemicals . . . Crush 4 feet Cubes of Rock . . . Shred Steel Turnings



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**ANIMAL...MINERAL
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Capacity from 50 pounds to 300 tons per hour

- Williams is the world's largest organization of crushing, grinding and shredding specialists and have developed standard machines for the reduction of practically every material whether animal, mineral or vegetable. Capacities range from 50 pounds to 300 tons per hour permitting selection of exactly the proper size for your work. Whether you wish to grind chemicals to 400 mesh, crush 4 feet cubes of rock or shred steel turnings, you can profit by Williams' experience.

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PATENT CRUSHERS GRINDERS SHREDDERS

many industries will face one of the major jobs, i.e., selling and distribution. Because of the disarrangement of markets, new products, changed population areas, competition, etc., selling and distribution will require a knowledge and intensive effort never before needed for domestic and export sales if we are to keep fully employed.

Reduced taxes are necessary, liberal credit arrangements are imperative and many companies will need long term loans for conversion, replacement of inventories, plant rehabilitation, payrolls and similar necessary items.

Every progressive company should be making expenditures for research. This may be either technical or commercial. Technical research may be directed toward the solution of problems affecting existing products or the use of material, plant equipment and processes or new products. Because only the executive officer of a company finally decides on a new product, constant direction and consultation with such official is needed so that valuable time, effort and money will not be wasted in useless investigations and researches. Commercial research to determine markets, advertising needs, consumer wants and demands as well as what dealers want to sell, problems of transportation, credit, etc., is needed in view of changed conditions brought about by the past five years of war.

W. G. Schneider, Nordberg Mfg. Co., before Milwaukee chapter, Michigan College of Mines & Technology Alumni Assn., Milwaukee, Jan. 26, 1945.

100 OCTANE AND BETTER

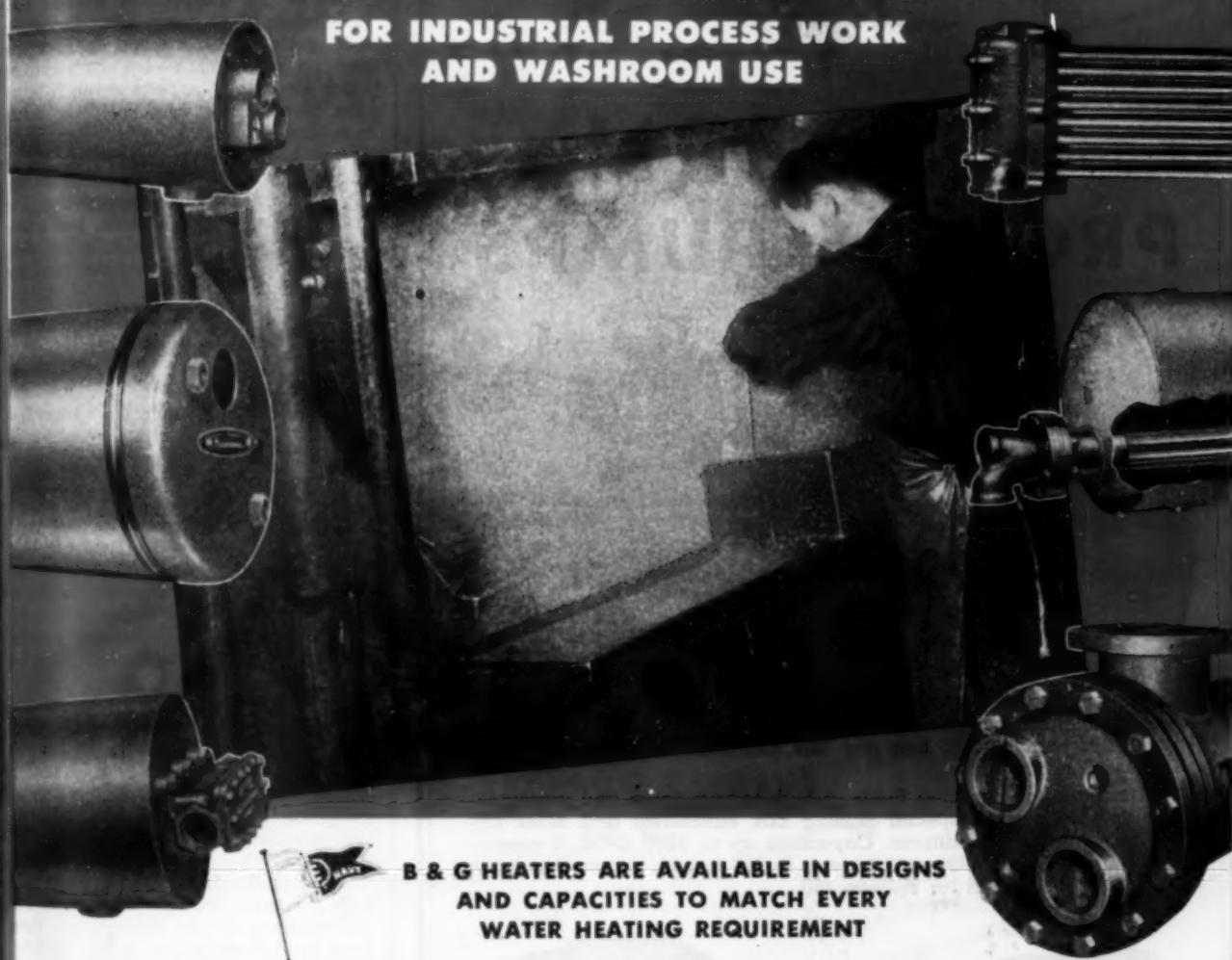
IN THE SUMMER of 1940 the total military demand for 100 octane was less than 10 thousand bbl. a day. The petroleum industry, spurred by competition and confidence in future demand, had developed capacity to make about 35 thousand bbl. per day, which was beyond the then estimated requirements of the military for two or three years ahead.

Soon the estimates of requirements began to soar. In the midst of frenzied wartime construction of all kinds of war plants the demand for 100 octane for the insatiable war machines climbed to 100,000-200,000-300,000-400,000 and finally 500,000 bbl. for every day. New constituents were found—new processes developed and put into commercial operation without waiting for the usual small scale try-outs. Thousands of chemists and engineers and refinery workers toiled day and night to get the plants into successful operation. The petroleum industry spent over 900 million dollars of its own money in plants to make hydrocarbons fit for modern aviation engines. Now we are producing that 500,000 bbl. per day of superfuel—about 75 percent of it consisting of man-made molecules—by processes not dreamed of a dozen years ago. The average refinery cost is now around 14c. per gal. (ex taxes, of course), and the quantities dwarf all other synthetic chemicals put together.

And that is not all. As soon as the end of the European war eases the demand for peak production we can leave out some of the less valuable compounds and

LOW COST HOT WATER

FOR INDUSTRIAL PROCESS WORK
AND WASHROOM USE



**B & G HEATERS ARE AVAILABLE IN DESIGNS
AND CAPACITIES TO MATCH EVERY
WATER HEATING REQUIREMENT**

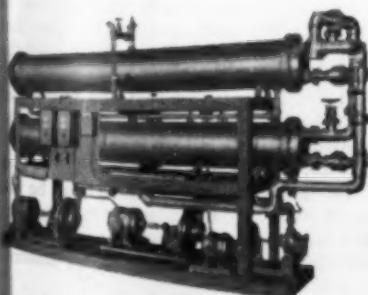
Better check your water heating facilities now—long service may have reduced efficiency or brought equipment to the breakdown point. Then look over the B & G line for a suitable replacement—you'll find it offers the last word in money-saving water heating apparatus.

Whether you want a Water Heater for tankless operation or for use with a storage tank . . . for installation on a steam boiler or hot water boiler . . . for furnishing hot water for process work or washroom use, B & G has

just the unit to economically meet your requirements.

B & G Water Heaters are known the country over for design which assures a maximum amount of hot water from a minimum size unit and with the least tax on the boiler. They give genuine satisfaction to the engineer who demands top efficiency from all his equipment.

Water heating costs go down and volume goes up where B & G Water Heaters are installed.

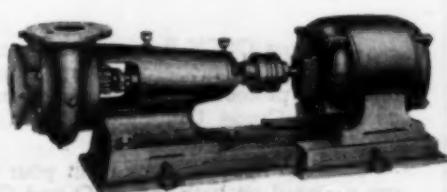


Typical example of a B & G Self-Contained Heat Exchanger Unit for oil cooling, fully equipped and ready for quick, easy installation.

B & G HEAT EXCHANGERS ... engineered to your requirements

The Bell & Gossett Company offers a helpful engineering service on all heat transfer problems. Whether you are planning to modernize present equipment or are experimenting with new ideas for faster production and better quality, there is no obligation involved by a preliminary consultation with B & G engineers.

B & G Heat Transfer Products can be furnished either as separate items or as self-contained units, complete with Heat Exchangers, Pumps, Controls and other necessary auxiliary equipment. Your request for information will receive prompt attention.



B & G CENTRIFUGAL PUMPS

Rugged, compact units, built to stand up under the strain of continuous operation. Available with semi-open or enclosed impellers—motors flexible coupled or integral with pump. Send for catalog.

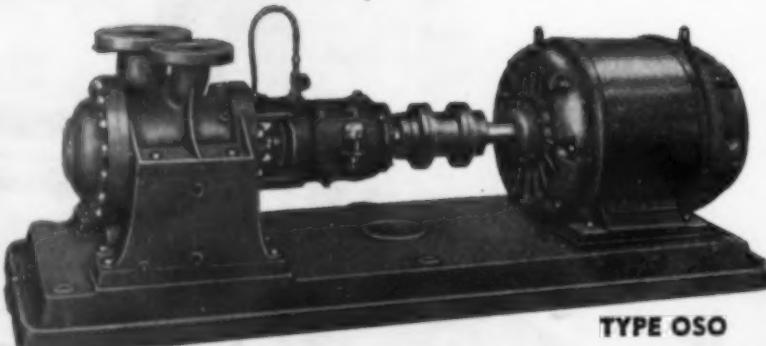
B & G

HEAT TRANSFER EQUIPMENT

BELL & GOSSETT COMPANY • MORTON GROVE, ILLINOIS

AMERICAN-MARSH PUMPS

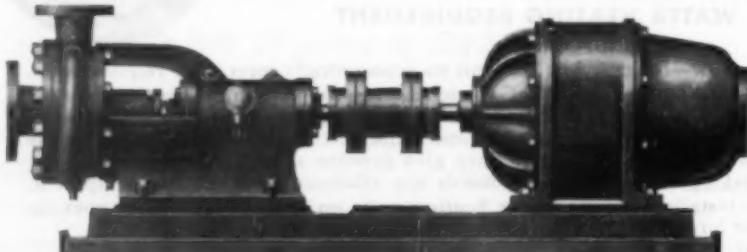
MODERN PROCESS PUMPS



TYPE OSO

New developments and changes in modern industry have created a demand for improved pumping equipment for handling fluids at high temperatures. American Marsh, with their broad knowledge of hydraulic engineering, has met this demand with the Type OSO Process Pump.

Designed for handling fluids at high temperatures and pressures; liquids that require special stuffing box structures; and other abnormal pumping conditions. Capacities up to 1200 GPM. Temperatures up to 800° F. Differential heads to 750 ft. with suction pressures up to 400 lbs. Send for Bulletin 460.



TYPE OSCV

The Type OSCV Process Pumps are especially designed for handling liquids of moderate temperatures (up to 350°F.) and also give maximum protection against corrosion in the pumping of such liquids as Acids, Crude Oil, Black Liquor, Ammonia, Organic fluids and others.

Material specifications to fit your own special pumping problems are optional on both the OSO and OSCV Process Pumps.

The OSCV is designed for capacities up to 1200 GPM. Temperatures up to 350°F. Differential Heads to 750 with suction pressures to 300 lbs. Send for Bulletin 461.

American-Marsh has been building pumps for over 70 years—you can benefit through this experience. Write now—representatives in all principal industrial centers.

AMERICAN-MARSH PUMPS INC.

BATTLE CREEK, MICHIGAN

produce three or four hundred thousand barrels per day of a real all-synthetic super fuel for the special benefit of the B-29s and the Japs!

Best of all, our research workers now have before them some other "unattainable" goals. There are two or three new stars on the horizon—few hydrocarbons which are in some respects as much better than iso-octane as iso-octane was better than any previous gasoline. Again, we do not know how to make them at reasonable cost. Moderate quantities are being synthesized rather expensively. The work of science is never done, but a new generation of young scientists is just itching to show us how far they can excel in achievements.

R. E. Wilson, Standard Oil Co. of Indiana, broadcast Feb. 18, 1945.

RUBBER MOLECULES

SYNTHETIC rubbers which we know how to make at the present time are as numerous as civilian tires are scarce. Only a relatively small number of these have found uses which warrant their manufacture, but the varied chemical composition of materials which are rubber-like is most striking.

Some are pure hydrocarbon (GR-S and butyl), some contain chlorine, oxygen or sulphur in addition to carbon and hydrogen, and one recently announced contains silicon as the key element rather than the conventional overworked carbon.

In spite of these wide variations of compositions, those interested in understanding why these materials are rubber-like have found that all of them possess similarities in their chemical architecture. All are composed of long thread-like molecules such as occur in many plastics, in silk and in cotton.

These molecules are too fine to see even with the most powerful microscope. The characteristic which distinguishes them from non-rubbery plastics is their flexibility and the ease with which they slip over one another. These properties permit high extensibility, or stretch.

In order for the rubber to display high strength, durability and other desirable properties it must be vulcanized. Vulcanization consists of chemical bonding of the thread-like molecules to one another. In this way the clump of filamentous molecules is converted to a loose mesh or network. These cross-bonds are too few to eliminate flexibility and extensibility, but they greatly improve the properties of the rubber.

It has been found that the lengths of the thread-like molecules influence the properties of the rubber in a definite way. They must be long for high strength, but if they are too long the rubber will be too tough to mill, mold and fabricate into tires and other useful products. Also, it is desirable that their lengths be as uniform as possible.

Properties of rubber also depend in a very definite way on the number of cross-links between the thread-like molecules. The greater this number the stiffer the rubber. The interaction of rubber with solvents also depends on the number of these bonds. When vulcanized natural rubber is placed in contact with solvents such as benzene, it imbibes a quantity of solvent

Use AIR POWER for PLANT MAINTENANCE



I-R Scaler removing old putty
from windows



I-R Impact Wrench dis-assembling
a pump



Multi-Vane close quarter
drill on repair job



I-R Scaler used for cleaning
machinery

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THERE IS AN AIR TOOL FOR EVERY JOB

- Air tools deliver maximum power per pound. Air tools are easy to control and safe to handle. Compressed air alone is an efficient tool... use it for cleaning motors and other machinery.

The illustrations show a few of the many uses of air power for maintenance work. Other applications include: Demolition... Digging... Back-Filling... Tamping... Spraying Paint and Insulation... Riveting... Cleaning Bricks... Sanding... Sawing... Hoisting and Pulling... Chipping... Chiseling... Hammering.

There is an I-R air compressor to furnish the air for all these operations — and an Ingersoll-Rand representative near you who knows Air Power. Send for your copy of "Air Tools," Catalog 5000.



Jackhammer drilling holes for
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DUST IS THE "PAY DIRT" OF INDUSTRY—CONTROLLED, it pays large dividends; unchecked, it becomes a great destroyer. Whether it is the recovery of valuable dust or if it is the checking of its destructive action, DUST, when it is controlled, will save the manufacturer many times the cost of installing and operating an efficient dust collector.

SCATTERED THROUGHOUT THE WORLD, THOUSANDS OF PANGBORN DUST COLLECTORS stand as conclusive proof that DUST CONTROL is an economic necessity to all modern industrial plants.

Write to us, we'll be glad to advise you on your particular dust problem—there is no obligation.



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PANGBORN CORPORATION • HAGERSTOWN, MD.

equivalent to as much as 5 to 10 times its own volume. Thus, the network structure acts like a sponge. Swelling characteristic of vulcanized rubbers are found to be closely related to their elastic properties.

P. J. Flory, Goodyear Tire and Rubber Co., before Southeastern Pennsylvania Section, American Chemical Society, Lancaster, Feb. 22, 1945.

POSTWAR POLYTHENE

POLYTHENE plastic is reported to be fungus-resistant and not attacked by salt water. Its use as an insulation on submarine cables, and in other applications where contact with salt water has deleterious effects on other materials, is being investigated. Protective coatings for metal parts which corrode in salt water also are being studied.

Polythene has very largely replaced other materials in the insulation of military wires for high-frequency use. After the war it is expected that the use of polythene in electrical equipment will continue and expand, and that further varieties and modifications of it will be developed to meet specific needs. Once the material becomes available in quantity for civilian uses, there will be many fields of application in which its unusual combination of properties will make it valuable. Its good resistance to chemicals points to its utility in chemical equipment as a coating and gasketing material. Its impermeability to moisture indicates a broad utility in containers and the packaging of foods. In this field it may be used as sheeting, as molding powder, or as an impregnant or coating of paper.

Outstanding properties upon which expanding postwar uses are expected to be based include flexibility over a wide range of temperatures, lightness of weight, unusually good resistance to water and to penetration by moisture, chemical inertness and excellent electrical properties.

At room temperature, it is substantially unaffected by concentrated hydrochloric, sulphuric, and even hydrofluoric acid, while nitric acid has no visible effect but does ultimately impair tensile strength and elongation.

The extrusion of polythene involves no special difficulty if suitable equipment is available and reasonable attention is given to control.

J. W. Shackleton, E. I. du Pont de Nemours & Co., before American Institute of Electrical Engineers, New York, Jan. 26, 1945.

CURRENT EFFICIENCY OF HOOKER TYPE S CELLS

IN CONNECTION with studies to determine the effect of operating the Hooker Type S chlorine cell under various conditions, the relationship between current efficiency loss and various reactions occurring in the cell were investigated and quantitative relationships between concentrations and current efficiency loss were developed. Methods of testing for experimental work and for control were worked out. All work was done with standard Type S cells in regular operation, and varying conditions from normal by means of a separate brine supply for the cell being tested. However, methods and funds

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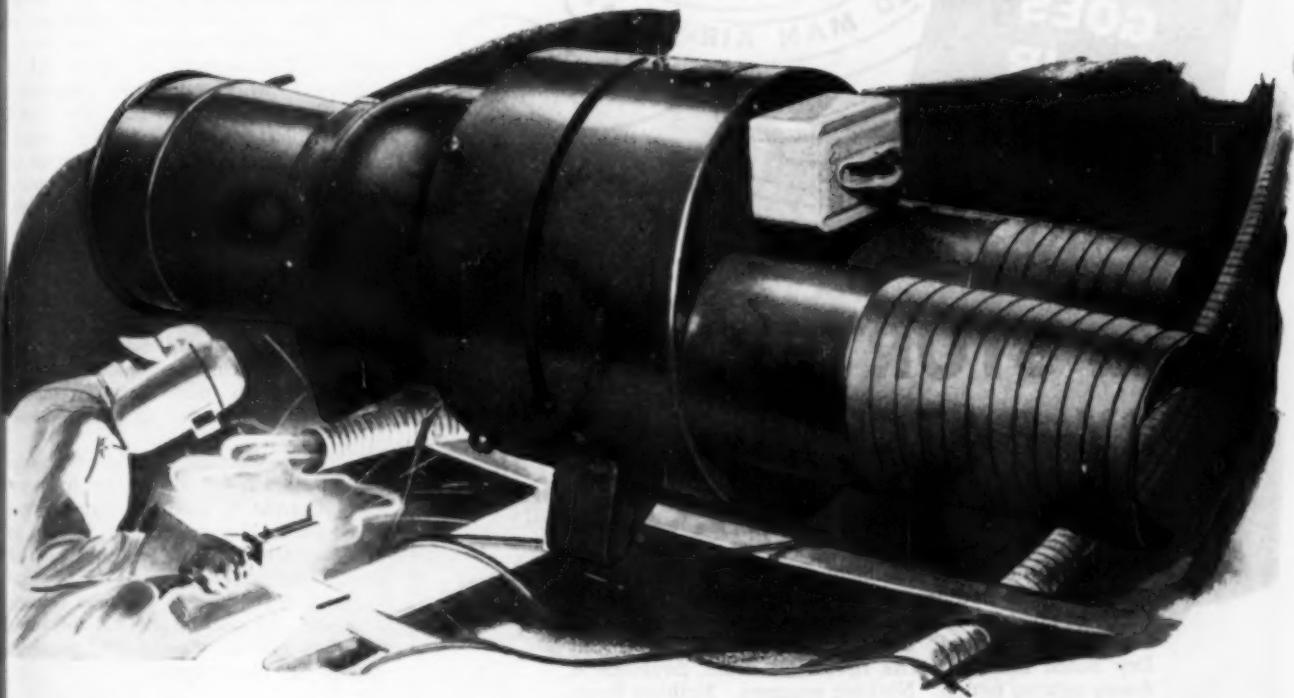
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An Extra Lung for A Man HAVING TROUBLE BREATHING



The amount of work a man can do goes down when foul air comes in or the heat goes up. Are you giving your workers the equipment that will keep them efficient even when working in hot or noxious fumes?

Many concerns regard Coppus Blowers as "production tools" as well as "safety equipment". They help men to do more work and better work.

You can find in the Coppus line the right blower or exhauster for each "bad spot"—or perhaps one type will handle a variety of jobs. In addition to man-cooling and removing

fumes from confined places, Coppus Blowers are used for cooling and drying materials and equipment. They are portable . . . efficient . . . built to Coppus "Blue Ribbon" standards of construction and workmanship in order to withstand severe usage.

Check and mail the coupon for specific information. Address Coppus Engineering Corp., 151 Park Ave., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

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Please send me information on the Blowers that clear the air for action.

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- in aeroplane fuselages, wings, etc.
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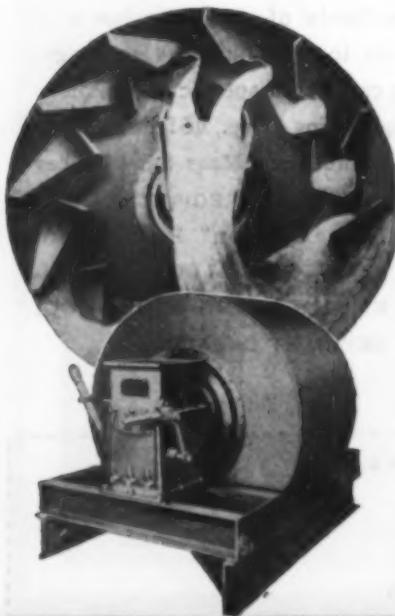
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The STURTEVANT DRY BATCH BLENDER eliminates "AIR-FLOAT"

"Air-float" means light substances float in air, remain unmixed with heavier particles. Result—an imperfect batch of chemicals, dyes, ceramics or whatever you're blending. "Air-float" can't happen in the Sturtevant Dry Batch Blender. The revolving drum develops a 4-way mixing action. Nothing escapes. Nothing floats free. You get a perfect blend of all particles.

Every batch completely blended..



The STURTEVANT eliminates "air-float" as well as loss of dust of finely ground materials. Every batch is uniform, perfectly blended—regardless of variation in weight, density, fineness, whether dust or granules. The opening for both intake and discharge is closed during blending. Capacities: 1000, 2000, 3000, 6000 and 7500 lbs. Simplicity of operation in all models is combined with strong, rugged construction.

WRITE today for bulletin 080B. No matter what your problems of Crushing, Grinding, Separating (Screen and Air), Mixing, Acidulating, Elevating and Conveying, there's a Sturtevant Product to do the work better—at lower cost. Ask us to send appropriate Bulletins.

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HARRISON SQUARE BOSTON, MASS.
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

mental principles would be applicable, with modification, to any type diaphragm cell.

Loss of NaOH production from theoretical is due almost entirely to migration of OH⁻ ions through the diaphragm from the catholyte to the anolyte. The alkali, NaOH, from the catholyte tends to decrease the hydrogen ion concentration of the anolyte, whereas several processes at the anode and in the anolyte tend to increase it. Consequently, a certain pH is established which depends principally upon the current efficiency, the NaOH concentration and the type and condition of the anode. The determination of anolyte pH is a convenient approximate test for the determination of current efficiency for control purposes.

Calculation of current efficiency from the oxygen and carbon dioxide content of the cell gas, as determined by an accurate and relatively quick analytical method, is a convenient means of determining current efficiency which compares favorably in accuracy with usual methods employing caustic liquor and current measurements.

Loss of production of chlorine may be incurred in any or all of the following ways: Current is used to form oxygen rather than chlorine; current is used to form chlorate by electrolytic oxidation of hypochlorite; chlorine is lost by chemical processes in the anolyte whereby chlorate is formed; chlorine dissolved in the anode liquor is lost as the anolyte percolates through the diaphragm.

R. L. Murray and M. S. Kircher, Hooker Electrochemical Co., before the Electrochemical Society, Buffalo, Oct. 12-14, 1945.

APPLICATION OF SILICONES FOR ELECTRICAL INSULATION

THE THERMAL endurance of insulation has long been recognized as an important limiting factor in electrical machine design. Investigations of numerous engineers and the electrical industry standards have clearly indicated that operating temperature is the determining factor for insulation thermal endurance and is therefore, the primary basis for establishing general machine ratings. It must be recognized, however, that there are frequently other design considerations which outweigh temperature limitation.

The advent of silicone resins is an important milestone in insulation development as these resins in combination with inorganic insulations such as mica, asbestos and fiber glass have unusually high thermal endurance. It appears that designers may utilize this excellent temperature resistance in three important ways when permitted by AIEE standards: (1) To reduce size and weight of some apparatus through increase in operating temperature; (2) to permit operation in a high ambient temperature; and (3) to obtain increased insulation service life or reliability where it is desired to maintain conventional size, weight and temperature.

Tests on silicone resins, silicone treated materials and wound apparatus treated with silicone varnishes demonstrate that: (1) An unusually high order of thermal endurance is obtained; (2) the materials are usable with relatively minor variations in conventional processes, (mainly

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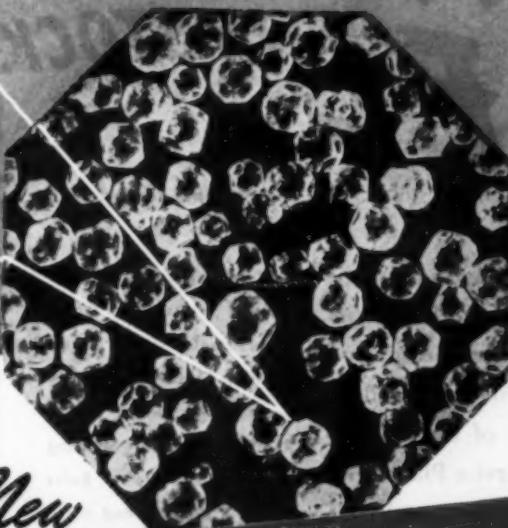
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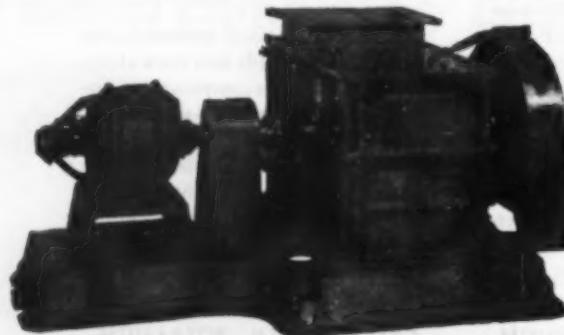
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in baking temperature); and (3) the on some types of electrical apparatus an appreciable advantage may be obtained in rating through operating at the higher temperatures when such are permitted by AIEE standards.

Silicone resins and composite HTS insulation materials promise considerable improvement in the thermal endurance of electrical insulation. The exact improvement is difficult to evaluate and will require much additional experience and test work. It is believed conservative to state that the silicone materials with which the authors are familiar have 50 to 75 deg. C. advantage over conventional Class B insulations.

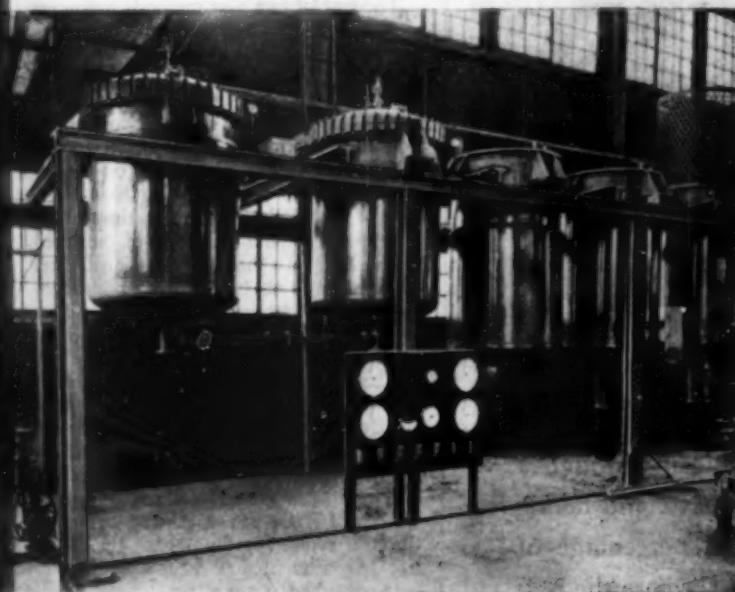
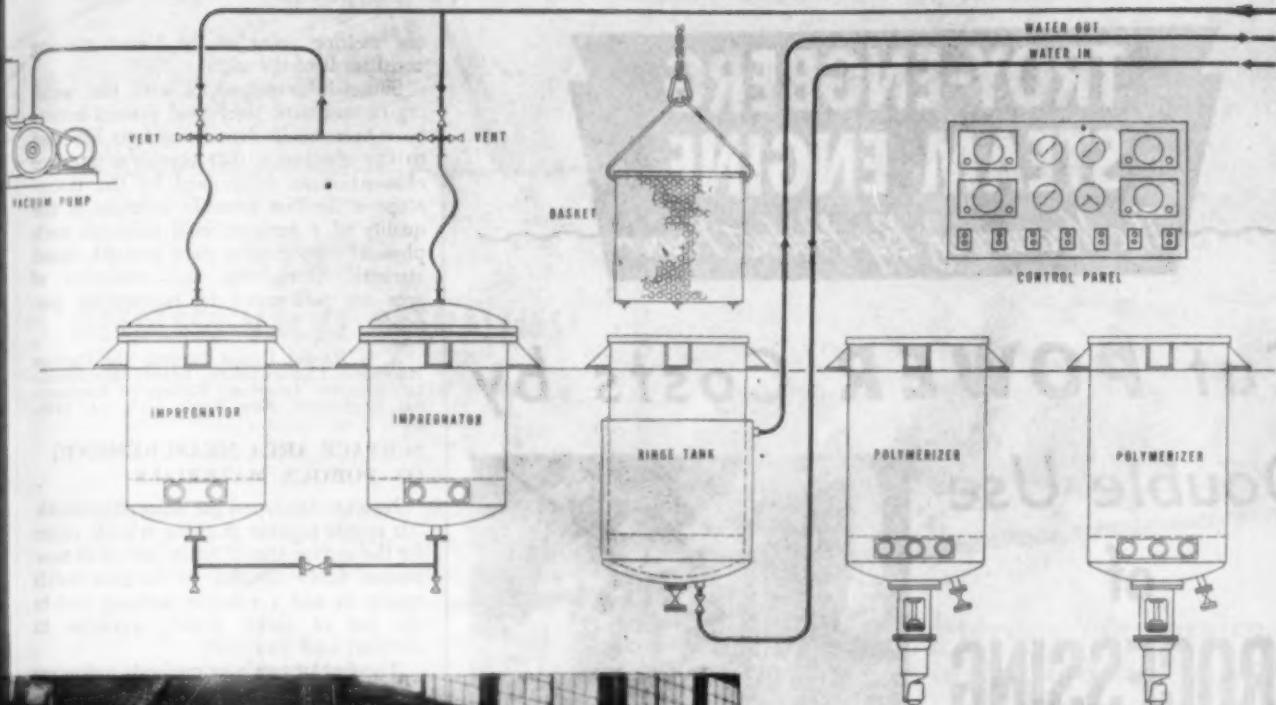
J. DeKlep, L. R. Hill and G. L. Moses, Westinghouse Electric and Mfg. Co., before American Institute of Electrical Engineers, New York, Jan. 22-26, 1945.

OXY-ACETYLENE PRESSURE WELDING

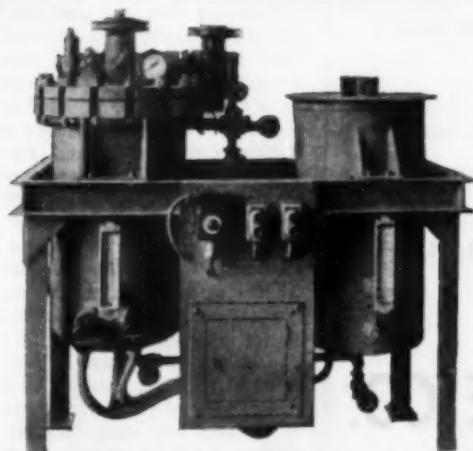
MATERIALS welded with difficulty by previous methods may now be joined by oxy-acetylene pressure welding, with added advantages of smoothness and uniformity of weld, short welding time, and relatively low unit cost. In this process, which may be fully or partly mechanized, the specimens are butted under nominal pressure, heated by means of multiple small oxy-acetylene flames to a temperature of about 1,200 deg. C. and upset to a controlled degree. The process possesses many special advantages over currently used mechanized welding methods among which are adaptability to those high-carbon and alloy steels that are welded with difficulty by fusion welding methods; smoothness and uniformity of the completed weld; short welding time and relatively low unit cost. The physical properties of these pressure welds are excellent. The process is being widely used for welding railroad rails, oval land pipes up to 24 in. in diameter, oil well tool joints, small liquefied gas tanks, boiler tubes and many other commercial welding operations.

Oxy-acetylene pressure-welding is known as "solid phase welding" because it is a method of joining two structural members in which none of the material is melted or brought to the liquid phase, at any time during the welding process. On this basis it may be defined as a process by which "structural members are bonded by atomic forces without the presence of a liquid phase at any stage of the process, comprising pressing together clean, smooth surfaces so as substantially to exclude air and maintaining suitable pressure while heating to effect bonding."

As a result of experimentation, it has been found that the bonding mechanism or method by which a sound, strong weld is obtained without the melting and fusion usually associated with the formation of a weld comprises atom transfer across the interface (contacting surfaces of abutting members) in accordance with the laws of diffusion with a resultant trans-interface crystallization. Temperature is found to be the dominant factor in the practical application of solid phase welding. A temperature of 1,050 deg. C. appears to be the feasible minimum for steel, with a maximum of about 1,200 deg. C., well below



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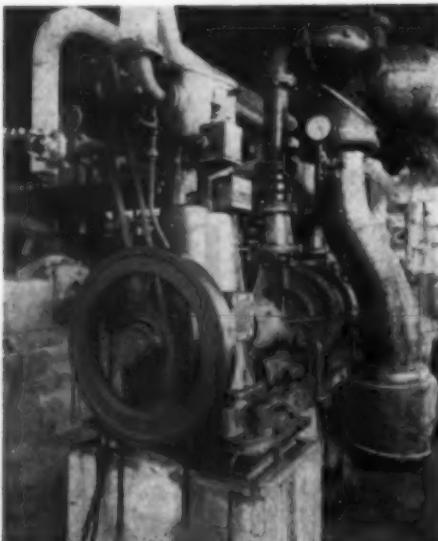
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the melting point of the lowest melting constituent of the metal.

Successful experiments with the welding of austenitic steels and various brasses have been made. Numerous tests have led to the conclusion that complete interface elimination as determined by the microscope is the best scientific criterion of the quality of a pressure weld although such physical properties as yield strength, tensile strength, elongation, and reduction of area are well-suited to engineering purposes.

A. B. Kinzel, Union Carbide and Carbon Research Laboratories, before Metropolitan Section, American Society of Mechanical Engineers, New York, Nov. 14, 1944.

SURFACE AREA MEASUREMENTS OF POROUS MATERIALS

NEWLY developed gas adsorption methods appear capable of giving reliable values for the surface area of either porous or non-porous finely divided or massive solids appear to add a valuable working tool to the list of those already available to chemists and physicists.

The first of two new methods makes use of curves representing the volume of nitrogen adsorbed by the surface of the porous or finely divided solid as a function of pressure at -195.8 deg. C., the temperature at which liquid nitrogen boils under a pressure of one atmosphere. A way has been found to select the point on the adsorption curves corresponding to a single layer of adsorbed molecules. A simple multiplication of the number of adsorbed molecules by the cross-sectional area (16.2×10^{-16} sq. cm.) of the nitrogen molecule, as estimated from the density of liquid nitrogen, yields an absolute value for the surface area.

The second is an entirely different method of plotting the low temperature nitrogen adsorption curves that does not require use of an assumed value for the cross section of the nitrogen molecules. Surface area of a finely divided non-porous sample of TiO_2 was measured by noting the heat evolved on immersing the sample in H_2O after it had been pre-saturated with adsorbed water vapor.

Assuming that the particles had been sufficiently coated with adsorbed water to cause them to evolve the same heat on immersion that would be evolved if the water coating were considered to be a film of ordinary water, the surface area of the particles can be calculated. By using this area a single nitrogen adsorption curve the necessary constant may be obtained for deducing directly surface areas of porous and non-porous materials from a linear plot of their nitrogen adsorption data.

On six non-porous solids compared, the agreement between the two methods was within 1 percent. On about 86 porous solids the agreement was within about 10 percent. This is considered to be remarkable in view of the fact that the methods of plotting and evaluating the nitrogen adsorption data are so entirely different.

A few examples of the magnitude of the surface areas of some common materials may be of interest. A 1-lb. sample of soil has been found to have a surface area equivalent to about 10 acres of a flat non-porous surface. Some of the finely di-

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vided carbon blacks have about 100 acres per lb. Average cement samples have only about 0.1 acres per lb.

In a number of instances important correlations have already been noted between the surface area and the other properties of finely divided or porous solids but for the most part application to industrial and scientific problems is only beginning to be made.

Substances whose areas have so far been determined by one or the other of the two gas adsorption methods mentioned above include paint pigments, inorganic salts, clays, carbon blacks, soil, soil colloids, cement, cuprene, paper, metallic catalysts, bacteria, porous glass, glass beads, powdered glass, a variety of metal powders, and catalysts for both the cracking of petroleum and the preparation of butadiene from hydrocarbons. A low pressure modification has also been used in evaluating the roughness factor of samples of sheet steel, silver foil and other forms of bulk metal. It is believed that these new methods for measuring surface area should find many applications in the science and technology of the future.

Paul H. Emmett, Mellon Institute of Industrial Research, before 11th annual chemical engineering symposium, American Chemical Society, New York, Dec. 29, 1944.

FLASH DRYING AND CALCINING DEVELOPED FROM MILL DRYING

MILL drying is today the accepted method of drying a great variety of damp solids used or marketed in dry powdered form. The logical development evolved consists of designs representing a transition from a pulverizer with incidental drying effect to a dryer with just enough pulverizing effect to break up agglomerations and promote rapid heat transfer. These latter machines are called flash dryers and no other term could better describe them. They are now being used for drying materials as divergent in character as yeast and sewage sludge, clay and coal, diatomaceous earth and lead carbonate. Moisture content in the feed runs from 1 to 80 percent. Some products are dried to only 15 percent as required, and others to zero.

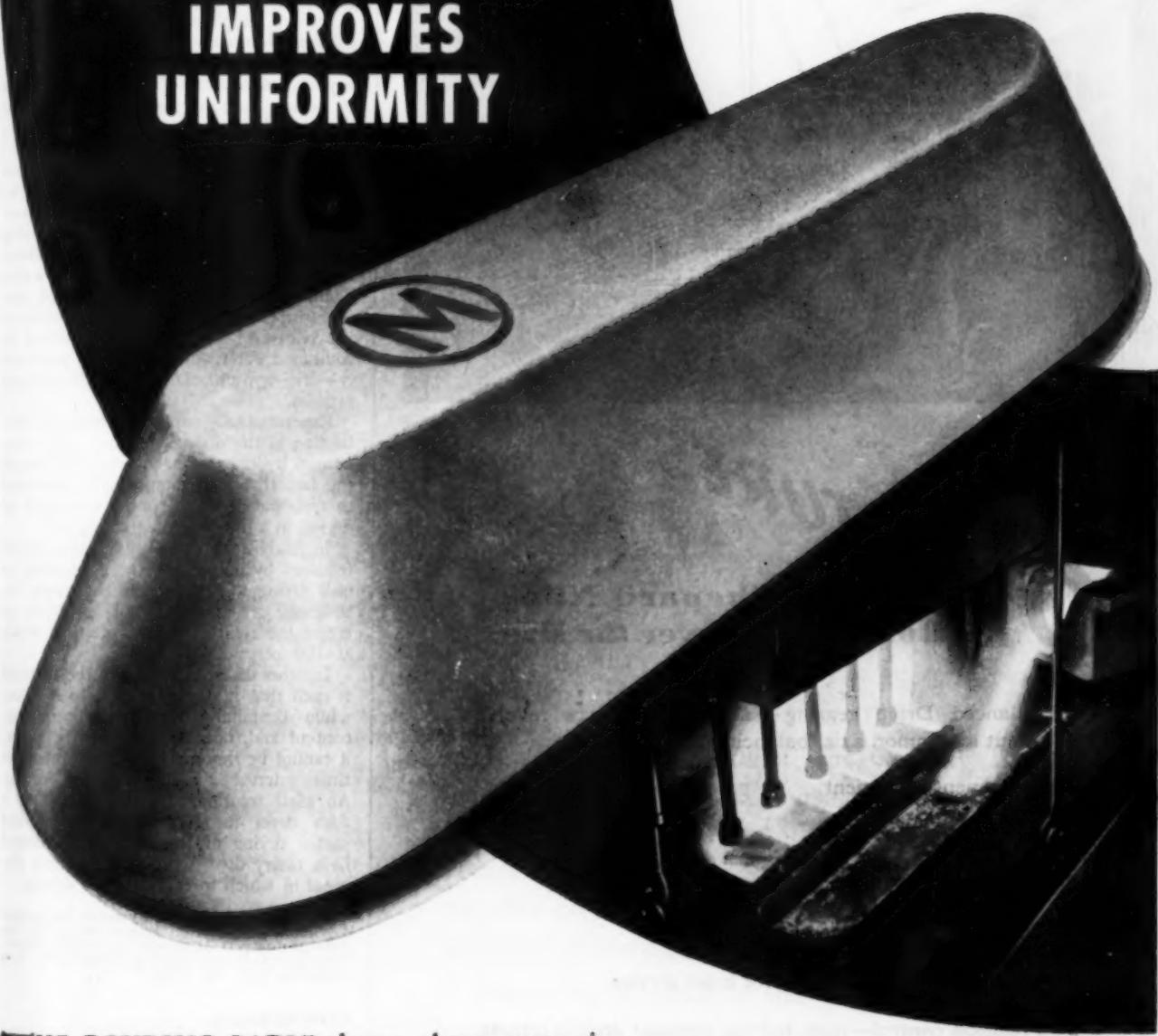
Vent temperatures as high as 380 deg. F. have been used. For these metal machines today's maximum may be far below tomorrow's, if the development in high-temperature steels continues at the pace of the past few years. And experiments now being conducted, using ceramic ware construction in the high-temperature zone, point the way for calcining temperatures as high as 2,000 deg.

For drying damp solids, mill drying is ideal. The use of a mill equipped with air separation eliminates the need for a dryer. In cases where waste heat is available, as when pulverizing coal for use as fuel, even the furnace is unnecessary. Mill drying is particularly valuable for drying insulating materials such as diatomaceous earth. These materials can be pulverized when damp, thus exposing a large surface for rapid drying. And high inlet temperatures can be used, hence high efficiencies obtained.

When close temperature control is im-

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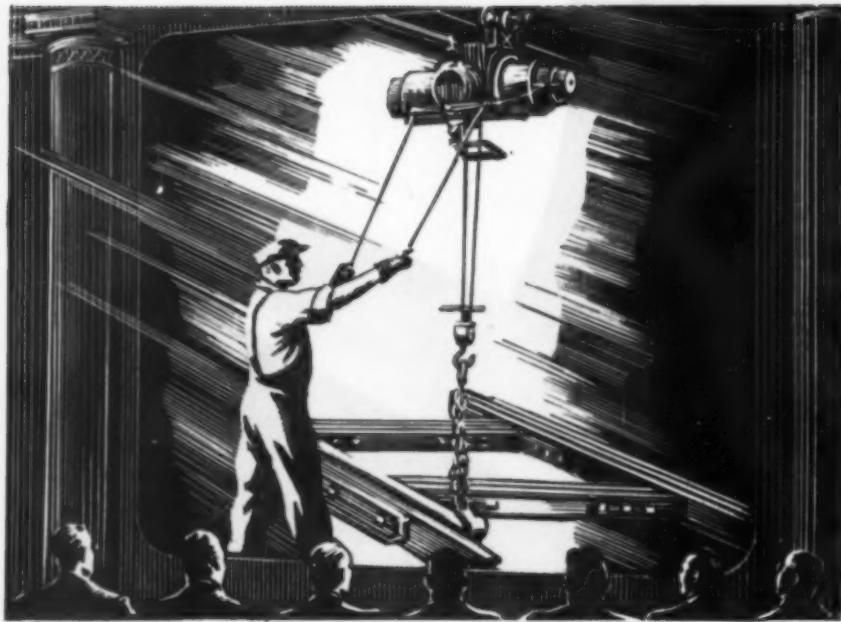
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portant, flash drying has no equal. The short retention period and turbulence within the system reduces temperature stratification and over- or under-drying to a minimum. It is also prominently successful in drying materials which can be injured by prolonged exposure to heat or gas.

Sodium sulphite is successfully dried without conversion to sulphate, as invariably takes place in conventional dryers if any oxygen is present. Excess air is used to reduce furnace gas temperature, but the material is exposed for too short a time for the conversion to take place.

Synthetic gypsum also well illustrates the value of the short time element. No laboratory combination of time and temperature has yet been devised for drying the particular material in question without releasing some of the combined water. Commercially, in a flash dryer, 20 per cent surface moisture is removed without the release of any appreciable amount of combined water, and the product produced is dry gypsum, not partially calcined gypsum.

Experimentally, using products of combustion as the drying medium, a dry magnesium hydrate has been produced despite the fact that it is intentionally converted to carbonate by the simple expedient of drying in a direct-fired rotary dryer.

In established plants, using rotary dryers followed by pulverizers, the application of mill drying will obviate the necessity for thorough drying in the rotary and thus increase the rotary capacity, often as much as 100 percent.

In other cases the nature of the material is such that it cannot be fed to a rotary while containing the original moisture content and, because of the particle size, it cannot be thoroughly dried in the short time interval available in flash drying. An ideal solution may be the use of a flash dryer for successful handling and partial drying of the wet feed, followed by a rotary dryer with a longer time element in which to complete the drying.

Wm. B. Senseman, Raymond Pulverizer Division, Combustion Engineering Co., before Industrial Minerals Division, American Institute of Mining Engineers, Los Angeles, Oct. 19, 1944.

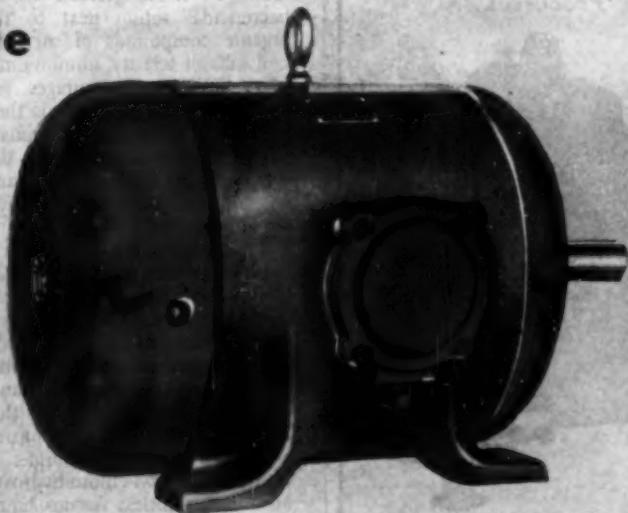
COMMERCIAL ENZYME PRODUCTION

DEFINING "commercial production" as that which produces enzymes in at least ton lots limits discussion to the manufacture of diastase, proteases and pectinases. There are four general sources of enzymes; namely, plant germination, gland secretions, fungi, and bacteria. The chief industries in which enzymes are used on a commercial scale are the manufacture of alcohol, tanning, textiles, in conversion of starch to sugar, in clarification of fruit juices, and in the manufacture of bakery items, cheese, and the tenderizing of meats. Increased knowledge in the future should bring more complete control to both accelerate and retard the reactions which are desired or undesired in fermentation processes.

J. A. Shellenberger, Kansas State College, before Midwest Section of American Association of Cereal Chemists, Chicago, Jan. 8, 1945.

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FOREIGN LITERATURE ABSTRACTS

HYDROXYBIPHENYL GERMICIDES

HYDROXYBIPHENYL compounds were found to have the greatest antiseptical and bactericidal action next to the metallo-organic compounds of mercury and certain salts of tertiary ammonium bases. One of their greatest advantages, as compared to the latter compounds, is their very low toxicity to warm-blooded animals and man. They are used as antiseptics, disinfectants, for preserving food, and for protecting various products from the activities of microorganisms.

Experiments conducted to find simple methods of preparing alkyl and alkyl-chloro-hydroxybiphenyls resulted in the development of a method for their preparation by condensation of alcohols with hydroxybiphenyls and chloro-hydroxyphenyls in the presence of anhydrous aluminum chloride. The one disadvantage of this method, however, is its high consumption of anhydrous aluminum chloride.

Alkyl and alkyl-chloro-hydroxybiphenyl is an almost odorless viscous liquid which is insoluble in water, readily soluble in organic solvents, and capable of yielding stable emulsions. Alkyl and alkyl-halogen-hydroxybiphenyls are believed to be more active on certain microorganisms than the hydroxybiphenyl itself but their application is limited due to relatively high cost and complexity of production.

A study was made of the action of these compounds on microorganisms which at-

tack wood, fruit and vegetables, as well as their action on pathogenic bacteria. They were found to preserve fruit from decay and there is reason to believe that they can be used effectively against tubercular bacilli in the future, due to their effect on acid-resistant microorganisms.

Digest from "Structure and Germicidal Properties of Organic Compounds" by N. N. Melnikov, M. S. Rokitzkaya and Z. E. Becker, *Zhurnal Prikladnoi Khimii XVI*, No. 9-10, 426-432, 1943. (Published in Russia.)

DETERMINATION OF FREEZING POINT OF OIL

FREEZING point can be determined by extending the viscosity-temperature line of Ubbelohde's diagram of viscosities, for which purpose this diagram must be enlarged to cover temperatures of -100 deg C. and viscosities of 3×10^6 centistokes. This viscosity is then assumed to be that of the freezing point, according to determinations made. The freezing point can thus be found by simple determination of the viscosity at two temperatures somewhere between 20 and 100 deg C., extending the viscosity line up to the viscosity of the freezing point and reading the corresponding temperature. This theoretical freezing point coincides approximately with the one determined experimentally in oils the viscosity of which approach the ideal, that is to say, which flow normally at low temperatures and obey Newton's law (outlet velocity proportional to the pressure).

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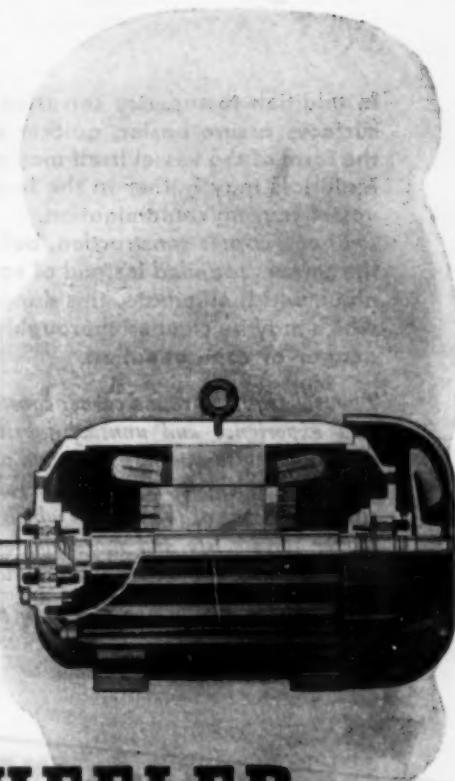
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In addition to superior corrosion resistance, stainless steel surfaces assure easier, quicker cleaning. Often, however, the form of the vessel itself may prevent thorough cleaning. Materials may gather in the less accessible corners of the vessel causing contamination.

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The techniques of round corner construction call for highly specialized experience and unusual fabricating equipment. We work exclusively with stainless steels and other corrosion resistant alloys. We offer our experience in the development of round corner construction as one of the ways in which we assure, during fabrication, longer service life and more efficient equipment. For your new equipment of stainless steel, consult with us.

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When oils have widely varying experimental and theoretical freezing points it follows that at low temperatures such oils do not flow normally, do not obey Newton's law and do exhibit abnormalities in their viscous structures. If this deviation is more than 10 deg. C. it can be definitely assumed that there will be abnormalities in the flow of the oil.

In order to determine the freezing point graphically the dimensions of the Ubbelohde diagrams should be increased so that their width is double that of normal diagrams. Obviously, manipulation of such diagrams would be difficult since even the normal ones are large. To avoid this in convenience it was proposed that the normal Ubbelohde diagrams should be used and the theoretical freezing point determined by simple extrapolation with the aid of an accompanying table. A given temperature, in deg. C., corresponds to each value of N in the table. The value of N is determined by the equation $N = (0.810 - W_{50}) / m$ derived from Walther's formula (used by Ubbelohde in the construction of the viscosity-temperature curves), in which W_{50} is the viscosity of the lubricating oil at 50 deg. C. and 0.810 is the double logarithm of the viscosity corresponding to the freezing point. The temperature corresponding to the value N is the (theoretical) freezing point obtained by extrapolation.

Digest from "Determination of the Freezing Point of an Oil by Extrapolation" by A. Petrikahn, *Oel u. Kohle*, 40, 132, 104 (Published in Germany.)

SILICA GEL

IT HAS been found by applying the law of capillarity that the diameter of the pores of silica gel is on the order of 2.5 millimicrons. This porosity is responsible for the adsorption of water vapor by silica gel. Other vapors, however, are also adsorbed, especially easily condensable gases such as carbon dioxide and sulphur dioxide. The superior adsorption of water vapor is of purely quantitative character, the above-mentioned gases being displaced at ordinary temperatures by the passage of humid air.

Degree of adsorption of different liquids can be determined by the heat liberated during the adsorption. For example, the number of calories per gram of silica gel is 7.3 for carbon tetrachloride, 10.9 for chloroform, 11.3 for toluene, benzene and xylene. However, it is 20.9 for water, 23.2 for ethyl alcohol, 22.9 for methyl alcohol and 20.8 for propyl alcohol. Adsorbing power of silica gel is high for water and the polar compounds, medium for aromatic hydrocarbons and weak for aliphatic hydrocarbons and their derivatives.

Vapor tension in equilibrium with silica gel is at a minimum while the gel is dehydrated and increases rapidly as the gel becomes charged with water. This is why the gel does not dry efficiently in a laboratory desiccator, but does so in industrial installations. In fact, in technical desiccators the air yields up a large part of its water to the first layers of the gel and is then prevented from contact with the highly dehydrated gel.

Numerous types of apparatus are described for drying gases with the use of

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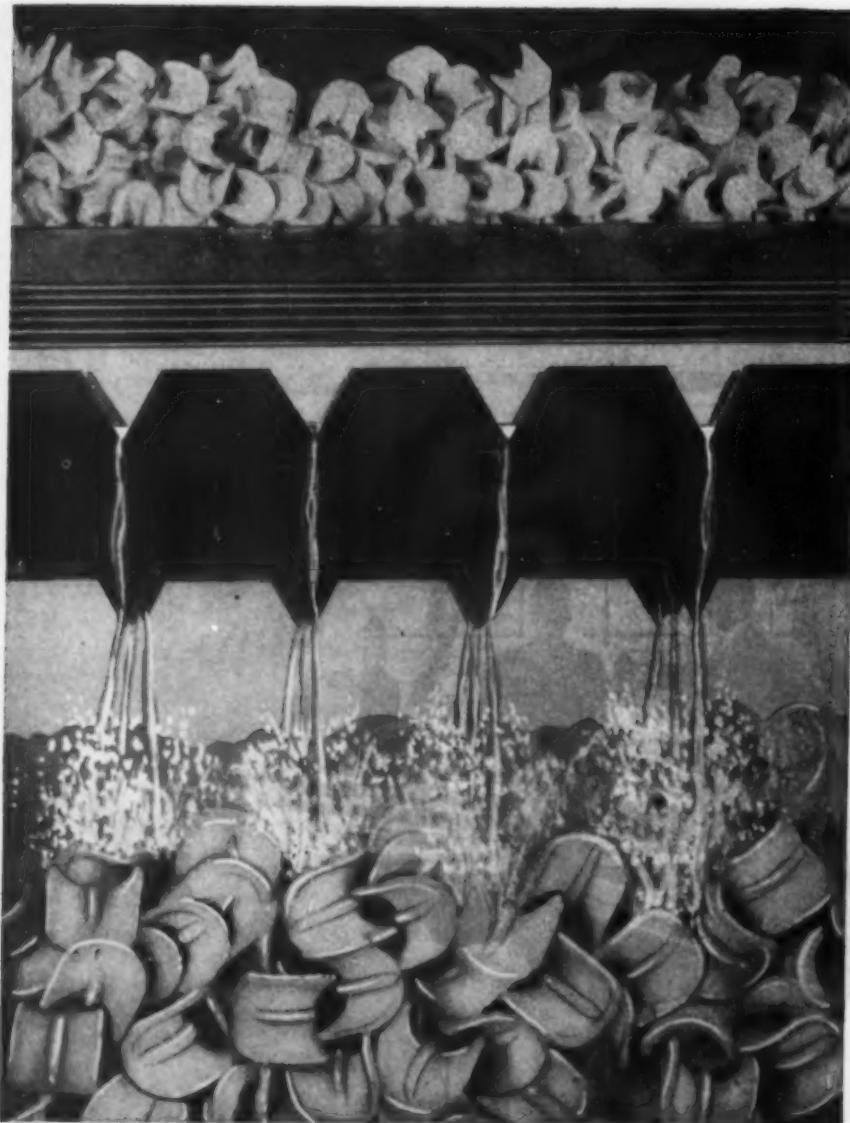
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silica gel. Hydrogen, coke gas and compressed air, in particular, are dried industrially by this method. Air is conditioned by means of silica gel and also dried for use in drying heat-sensitive materials. This type of drying is also used in the manufacture of films and explosives.

Digest from "Scientific Principles and Technical Progress in the Application of Silica Gel" by R. Duntze, *Chem. Ztg.* 46, 196, 1942. (Published in Germany.)

FUNGICIDE FOR SEED

A NEW method has been developed by the Institute of Chemistry and Physics of the USSR Academy of Sciences for the cold-flame oxidation of hydrocarbons to produce aldehyde-containing solutions which have strong disinfectant properties. Laboratory and field experiments showed that the new product can be substituted for formalin in fungicidal treatment of seed grain and is an excellent agent for combating plant diseases.

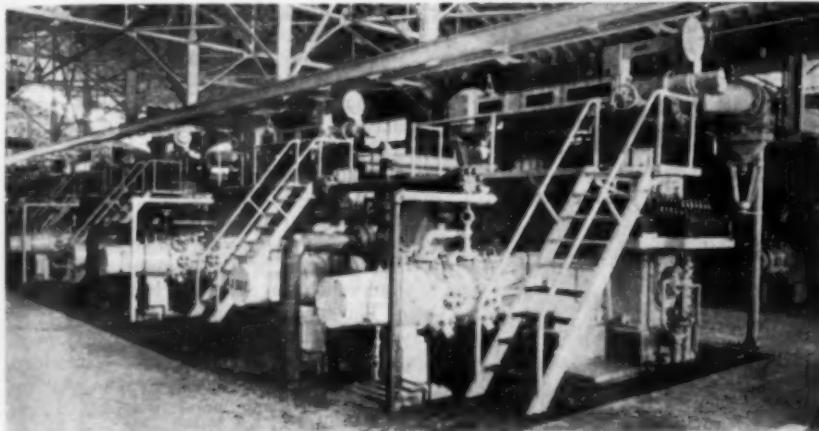
A pilot plant was set up for the oxidation of byproducts from the synthetic rubber industry, the so-called motor fuel synthetic rubber, to develop a practical process for commercial use. Experiments were conducted with the reactor at two different temperatures: 400 and 440 deg. C., the temperature fluctuating in the range ± 10 deg. The process was unstable at 380 deg since a 10 deg. drop in temperature frequently extinguished the cold flame. The optimum temperature regime for the pilot plant apparatus was 450 to 420 deg. C. for the reactor. The optimum temperature for the evaporator and air preheater was found to be 200 deg. C.

Aldehydes were washed out of the layer of light hydrocarbons with water. This layer was found to contain a considerable quantity of aldehydes and about 65-70 percent by weight of unreacted motor fuel. The problem was to extract the aldehydes from the light layer in such a way that the aldehydes could be utilized commercially. This was accomplished by washing the light layer with a counterstream of water. On the average, the heavy layer contained approximately 25 percent of the total aldehydes, the light layer contained 26 percent, the aqueous liquor from the first scrubber contained 3-4 percent, and the liquid from the second scrubber contained 40-45 percent. The remaining part of the aldehydes is lost in the exit gases. All the aldehydes of the heavy layer can be utilized for treatment of grain. Sixty percent of aldehydes can be extracted from the light layer with a 4 percent concentration. Approximately 12 percent of the total aldehydes are therefore found in the wash waters and experiments showed them to be perfectly satisfactory for treatment of grain. The liquor from the second scrubber, however, contained an acrolein fraction with a 23 percent content of aldehydes by weight. This fraction was found to be toxic to grain. Such toxic aldehydes comprised 5.7 percent of the weight of motor fuel originally used.

Digest from "Production of Aldehydes by Oxidation of By-Products from the Synthetic Rubber Industry" by E. A. Andreev, V. I. Avramenko, M. N. Mikhailov and F. Moshnikov, *Zhurnal Prikladnoi Khimii* XVI, No. 9-10, 356-364, 1943. (Published in Russia.)

CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor



Compressors in the Lake Charles DPC plant, one of two largest in the country making ammonia from natural gas, operated by Mathieson Alkali Works

COMPRESSOR DATA

AIR COMPRESSORS. By Eugene W. Feller. Published by McGraw-Hill Book Co., New York, N. Y. 406 pages. Price \$4.50.

Reviewed by Donald F. Othmer

INTENDED for the operation engineer, this book is an excellent review of the selection, design, construction, control, accessories, and thermodynamics of air compressors. The various types: reciprocating, rotary, centrifugal, axial flow, and hydraulic are discussed in detail and compared as to fields of usefulness, maintenance, operating costs, etc. Numerous excellent charts and nomograms aid in calculations of power costs, friction losses, moisture content, heat content, values of PV , and other functions. Over 400 well selected drawings and photographs completely illustrate the text. This book represents a very adequate coverage of this field for almost every practical, instructional, and theoretical purpose.

COLLABORATIVE EFFORT

OUTLINE OF THE AMINO ACIDS AND PROTEINS. Edited by Melville Sahyun. Published by Reinhold Publishing Corp., New York, N. Y. 251 pages. Price \$4.

Reviewed by Morris B. Jacobs

It is stated that the purpose of this collaborative effort of thirteen contributing authors "is to outline in a simple and readable manner the essentials of the chemistry and biochemistry of amino acids and proteins." The book is designed to fill the gap between the comprehensive texts dealing with the chemistry of the amino acids, peptides and proteins which have appeared in recent years and the partial treatment accorded this subject in texts of general biochemistry. The problem of providing an elementary text to serve as an introduc-

tion to the field has been met by dividing the subject into twelve chapters, discussing (1) discovery of the amino acids; (2) occurrence, amino acid content and properties of proteins; (3) protein structure; (4) hydrolysis of proteins; (5) synthesis and isolation of amino acids; (6) methods of analysis; (7) relation to immunity; (8) relation to biologically important products and detoxication; (9) metabolism; (10) intermediary metabolism of individual amino acids; (11) nitrogen equilibrium and biological value; and (12) nutrition.

Several of the topics are treated comprehensively, particularly the topics on methods of analysis and of synthesis and isolation, but others receive sketchy treatment. Thus the relation of amino acids and their derivatives to immunity is allotted five pages and protein structure is considered in nine pages. It is questionable whether a strict chronological historical development is suitable for an elementary text.

The book may prove to be useful. There are, however, certain aspects of treatment which might be reconsidered. These are (1) equalization of the treatment accorded to various topics, (2) the use of larger type for the printing of the many references, (3) better continuity, and (4) the elimination of duplication at several points in the text. The latter two are difficult in a text prepared collaboratively, but can be solved by closer editing. It is a rather poor selection of illustrations which gives from Chapter III through Chapter XI nine prominent German protein chemists in a row. It is certain that at least one other protein investigator of equal prominence of some other national origin could have been selected within the period of time covered, namely, from 1803 to 1927.

There are few typographical errors in the text. There is one formula which appears on p. 52 of coenzyme II which is

probably incorrect. Coenzyme I and coenzyme II probably contain only two phosphoric acid groups lined up in series that is in the pyrophosphate configuration. The third phosphoric acid residue present in coenzyme II is probably attached to one of the ribose constituents as a side chain.

PLUMBISM

LEAD POISONING. By Abraham Cantarow and Max Trumper. Published by Williams & Wilkins Co., Baltimore, Md. 264 pages. Price \$3.

Reviewed by John C. Olsen

THE AUTHORS give a surprisingly complete and clearly presented account of every possible phase of the very important subject of lead poisoning.

In Chapters I, II and III, they discuss the pathology of lead, giving an account of the entrance and effect of lead on the various organs of the human body. There would seem to be no part of the human body which this poison does not penetrate, no function of the body which it does not affect. These chapters give the results of the extensive medical research which has been carried out to ascertain just how this insidious poison does its work. The results obtained by the numerous investigators are freely quoted, references being given to the published articles. The bibliography at the close of the volume covers 18 pages. Investigators do not always agree in their findings—as might be expected—on such a difficult subject. The student of this subject will no doubt wish to read the original articles and reach his own conclusions, even though the authors seem to have reported each investigation without prejudice. The authors also indicate where the preponderance of results favor a given conclusion.

After concluding the chapters on the pathology of lead poisoning, the authors devote Chapters IV, V and VI to the clinical manifestations of lead poisoning. This part of the subject is covered in the same thorough manner as the pathology of lead poisoning. While references to the literature are cited in these chapters, the generally recognized effects of lead poisoning are given in a systematic manner. The differing effects on men, women, children

RECENT BOOKS RECEIVED

Asphalts and Allied Substances. 5th ed. By H. Abraham. Van Nostrand. \$20.

Cane Sugar Handbook. 8th ed. By G. L. Spencer & G. P. Meade. Wiley. \$7.50.

Introductory General Chemistry. 3rd ed. By S. R. Brinkley. Macmillan. \$4.

The Modern Gas Turbine. By R. T. Sawyer. Prentice-Hall. \$4.

Plastics, Scientific and Technological. By H. R. Fleck. Chemical. \$6.50.

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and workers in industry are clearly pointed out.

Chapters VII and VIII are devoted to the presentation of the "normal" content of lead in the blood, body fluids, and excretions. It seems that all of us are consuming lead daily. Many of our foods contain lead. The authors give us the exact amounts so that they can devote a chapter to the "normal intake of lead."

Chapter IX gives the treatment of lead poisoning. This chapter is devoted mainly to precautions to avoid exposure to lead, particularly in industrial plants. The precautions given here are very specific. There is also considerable medical advice as to treatment. Chapter X on chronic lead poisoning and Chapter XI on lead products in industry are concerned with the danger of lead poisoning in various industries and the precautions which should be taken to avoid the hazards. The volume ends with a very useful and excellent chapter on sampling and qualitative and quantitative tests for the minute amounts of lead which can do so much damage.

The typography of the volume is excellent. It closes with a well prepared index. This volume deserves wide circulation among physicians, chemists, chemical engineers and plant operating staff; and even the intelligent workman who may be exposed to lead fumes can read it with profit.

RECENT BOOKS

and

PAMPHLETS

Directory 1944-1945. Published by Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y. 247 pages. Price \$2.50. Activities of the society, company members, professional members, who's who in plastics, and indexes of products, materials, machinery and companies.

Proceedings of the Annual Convention of the National Fertiliser Association. Published by the Association, 616 Investment Bldg., Washington 5, D. C. 74 pages. Papers presented at the Atlanta meeting last June.

The Visimeter. By C. D. Miller, 327 Salem St., North Andover, Mass. 24 pages. Price \$1. Description and mathematics of the Visimeter, a patented device utilizing a metering pump as a means to develop pressure by which to measure viscosity.

A Preliminary Report on the Plastics Industry as Related to Pacific Northwest Development. By A. J. Norton. Released by U. S. Department of the Interior, Bonneville Power Administration, Portland 8, Ore. 37 pages. Relationship of Columbia River power to possible development of a plastics industry in the Pacific Northwest. Structure of the plastics industry as it relates to opportunities for manufacturing in the Pacific Northwest.

National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives, 1945. Published by National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass. 592 pages. Price \$3. Up-to-date information superseding the 1943 Codes.

A Study of the Flow Properties of Concentrated Clay-Water Mixtures. By W. J. Smothers and P. G. Herold. Technical Series Bulletin published by Missouri School of Mines, Rolla, Mo. 101 pages.

Opportunity for Private Enterprise. Published by National Physicians Committee Pittsburgh Bldg., Chicago 2, Ill. 46 pages. A report on employer-employee group insurance programs and conclusions based on nation-wide surveys as to need and value of such programs.

What Foreign Trade Means to You. By Maxwell S. Stewart. Pamphlet No. 99 published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 32 pages.



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Designing for Die Casting, 1945 Edition. Published by New Jersey Zinc Co., 160 Front St., New York 7, N. Y. 64 pages. Compiled to serve as an aid to design engineers.

Stabilizing the Construction Industry. By Miles L. Coleen. Planning Pamphlet No. 41 published by National Planning Association, 800-21st St., N. W., Washington 6, D. C.

38 pages. Price 25 cents. According to the report, one of the most important steps in balancing the national economy at full employment levels after the war will be stabilization of the construction industry.

Enemy Material From the Metallurgical Point of View. By J. R. Cady, H. W. Gillett and L. H. Grenell. Published by American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. 32 pages. Reprint from Metal Progress, Feb. 1945, pp. 289-320. General impressions of overall trends.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give the complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.

The Businessman's Bureau. By Corrie Cloyes. Bureau of Foreign and Domestic Commerce. Economic Series No. 40. Explains scope and character of Bureau's service available.

Foreign Trade Associations in the United States. By C. J. Judkins. Bureau of Foreign and Domestic Commerce. Economic Series No. 43. Mimeographed.

Chemical Statistics. Inquiry Reference Service of the Bureau of Foreign and Domestic Commerce has issued five additional mimeographed unnumbered documents giving a "Synopsis of Information" on the following subjects: Nitric Acid, Anhydrous Ammonia, Phosphoric Acid, Sulfuric Acid, Sulfur Dioxide.

Our Forests: What They Are and What They Mean to Us. By Charles E. Randall and Marie Foote Heisley. Department of Agriculture. Miscellaneous Publication No. 162. Price 10 cents.

The Construction Industry in the United States. Bureau of Labor Statistics. Bulletin No. 786. Price 20 cents.

Cooperative Associations in Europe and Their

Possibilities for Post-War Reconstruction. By Florence E. Parker and Helen I. Cowan. Bureau of Labor Statistics. Bulletin No. 770. Price 5 cents.

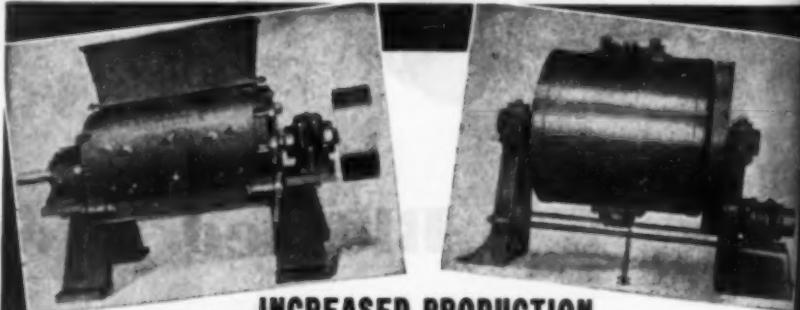
Social Security Yearbook 1943. Annual Supplement to the Social Security Bulletin. Social Security Board. Price 45 cents.

Dictionary of Occupational Titles. Part II. Entry Occupational Classification. Revised Edition. Division of Occupational Analysis, War Manpower Commission. Price 35 cents.

Mineral Oils, Alone or Combined with Insecticides, for Control of Earworms in Baum Cora. By G. W. Barber. Bureau of Entomology and Plant Quarantine. Technical Bulletin No. 880. Price 15 cents.

Government Owned Patents and Inventions. Government Employees and Contractors. Second Report of the National Patent Planning Commission. Also available as House Document No. 22, 79th Congress. Price 10 cents.

Effects of Fire on Gum Yields of Long and Slash Pines. By V. L. Harper. Department



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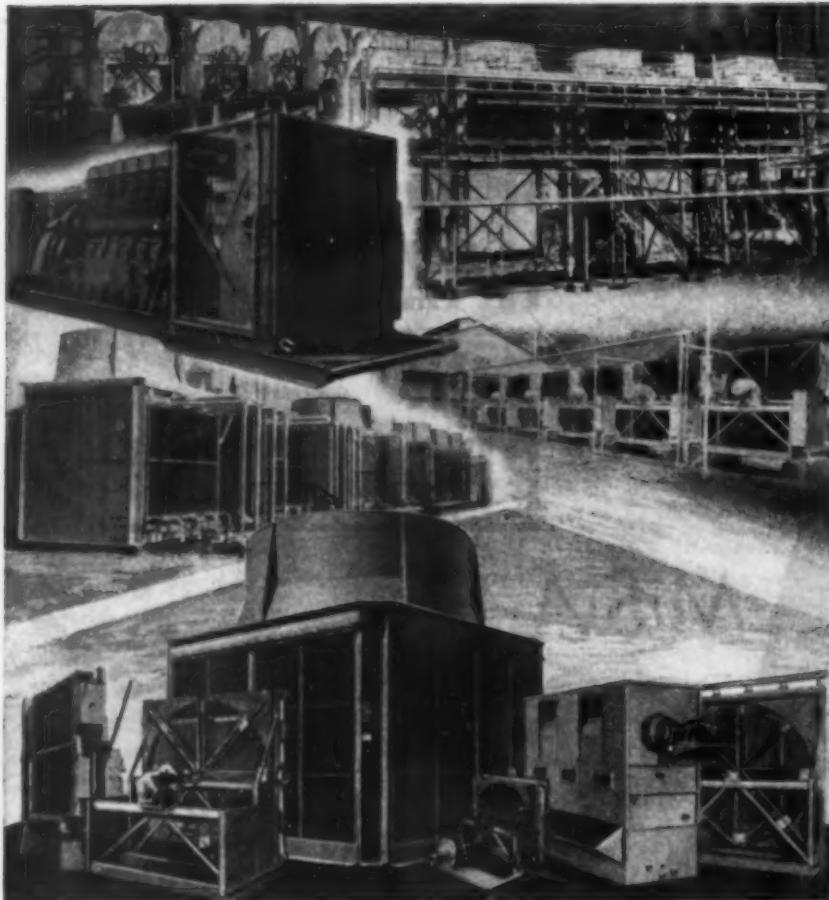
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of Agriculture. Circular No. 710. Price 5 cents.

Place and Season Effects on Yields and Starch Content of 38 Kinds of Sweetpotato. Department of Agriculture. Circular No. 711. Price 5 cents.

Portable Storage Batteries and Dry Bath Section II, Chapter 62, Bureau of Ships Manual. Bureau of Ships. Price 15 cents.

Engineer Foundry. War Department. Technical Manual TM 5-228. Price 15 cents. Elementary guide to milling and casting.

Fumigation and Bath Company. War Department. Technical Manual TM 10-645. Price 15 cents. Includes instructions for use of insecticide and detergent chemicals.

Beryllium and Tungsten Deposits of the Mountain District Sierra and Socorro County, New Mexico. By Richard H. Hahn. With section on the Beryllium Minerals by Jewel Glass. Geological Survey. Bulletin 945-C. Price \$1.25.

Water Supply Papers. U. S. Geological Survey is now issuing its series of Water Supply Papers giving ground water levels and water pressure noted in various parts of the United States. Chemical engineers interested in appraising present or prospective water supply should indicate the areas of interest in requesting these documents. In most cases data through 1942 are available.

Effect of Desulfurization on the Lead Content of Distillates from Some Crude Oils from Texas, New Mexico, and Oklahoma. Boyd Guthrie and M. C. Simmons. Bureau of Mines. Report of Investigations R. I. 3792. Mimeographed.

Classification and Tabling of Birmingham (Ala.) Red Iron Ores with Recommendations for Added Recovery. By Will H. Coghill, Dale Coe, and Homer N. McDonald. Bureau of Mines. Report of Investigations R. I. 3793. Mimeographed.

Sponge Iron. By R. S. Dean. Bureau of Mines. Report of Investigations R. I. 3794. Mimeographed.

Water Flooding the McClosky Limestone Clay City Oil Field, Clay County, Ill. By C. Riggs. Bureau of Mines. Report of Investigations R. I. 3792. Mimeographed.

Effect of Lubricating Agents in a Diamond Drilling-Bit Coolant and Cuttings-Removal Fluid. By Albert E. Long and Wing G. Agar. Bureau of Mines. Report of Investigations R. I. 3793. Mimeographed.

Studies on Explosives and Explosions, Part I, Year 1944. By Wilbert J. Huff. Bureau of Mines. Report of Investigations R. I. 3794. Mimeographed.

Preparation Tests of Lignite from a Deposit Near Toledo, Lewis County, Washington. H. F. Yancey and M. R. Geer. Bureau of Mines. Report of Investigations R. I. 3795. Mimeographed.

National Motor-Gasoline Survey, Summary 1944. By O. C. Bladé. Bureau of Mines. Report of Investigations R. I. 3796. Mimeographed.

Shaft Sinking by Stripping Churn-Drill Hole. By W. A. Cole. Bureau of Mines. Information Circular I. C. 7308. Mimeographed.

Potash Salts from Texas, New Mexico and Halite Deposits. Bureau of Mines. Bulletin 945. Price 20 cents.

Annual Reports. During January and February printed copies have been issued by the Bureau, Departments, and independent agencies of the annual reports to Congress covering the Government fiscal year ending June 30, 1943. Those interested in reviewing all the activities of any such agency can generally get the reports as the best guide to such review.

Federal Placer-Mining Laws and Regulations. By Fred W. Johnson. Part II. Small-Size Placer-Mining Methods. By Charles F. Johnson. Bureau of Mines. Technical Paper 10. Price 10 cents.

Federal Specifications. New or revised specifications which make up Federal Standard Catalog have been issued on the following items: Fire-Extinguishing-Liquid: Carbon Tetrachloride Base; O-F-380a; price 5 cents. Fire-Extinguisher Map, High Wet-Strength: UU-P-361; price 10 cents. Feedstuffs: Concentrated: N-100; price 10 cents. Medicinal Products and Clinical Laboratory Reagents; General Specifications: Containers (Packaging and Packing); U-M-4; price 10 cents.

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Air Diffusers. W. B. Connor Engineering Corp., 116 E. 32nd St., New York 16, N. Y.—75-page loose-leaf catalog describing the selection and application of air diffusers. Also given are specification details plus various tables and graphs showing capacities, and performance data.

Air Filters. Air Devices, Inc., 17 E. 42nd St., New York 17, N. Y.—15-page booklet giving complete information on Agitair air filters. Performance data, sizes, and capacities given. Bulletin AF-44-1. Also, 2-page leaflet on wind and fan actuated exhausters. Bulletin EX-44-1.

Air Handling Equipment. Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago 41, Ill.—8-page brochure featuring this company's research laboratory.

Air Handling Equipment. B. F. Sturtevant Co., Hyde Park, Boston 36, Mass.—199-page catalog and data book describing this concern's complete line of air-handling equipment.

Air Heaters. J. O. Ross Engineering Corp., 350 Madison Ave., New York 17, N. Y.—4-page folder showing features of the Ross recirculating indirect air heater. Bulletin No. 137. Also 4-page folder describing this company's infra-red heated oven. Bulletin No. 145.

Barometric Condensers. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.—8-page folder illustrating both the disk-flow and ejector-jet types of barometric condensers. Form 9012.

Battery Charger. B. F. Goodrich Co., Akron, Ohio—2-page leaflet illustrating the auto charger for flashlight storage batteries. Catalog Section 12030.

Beryllium-Copper Alloys. The Beryllium Corp. of Pennsylvania, Reading, Pa.—16-page illustrated booklet giving information on the physical properties of beryllium-copper alloys.

Burner Controls. Askania Regulator Co., Inc., Michigan Ave., Chicago 16, Ill.—Bulletin giving a discussion of furnace control. Bulletin No. 122.

Centrifuges. The Sharples Corp., 2300 W. moreland St., Philadelphia 40, Pa.—10-page article discussing the theory of design, installation and operation of centrifugal clarifiers and separators. Bulletin 1226-C. 10-page illustrated booklet showing how centrifugal bowls function. Bulletin 1230-B. 20-page booklet describing equipment for the selective clarification of liquors, paints and enamels. Bulletin 1234-B.

Chemicals. Hercules Powder Co., Wilmington, Del.—36-page booklet listing various chemical products and the industries which they serve. 16-page pocket-size catalog giving properties of chemicals available from this company.

Chemical Stoneware. U. S. Stoneware Co. Process Equipment Division, Akron, Ohio—4-page catalog describing chemical stoneware equipment for storage and mixing of acids and corrosive materials. Bulletin 405.

Chlorinators. Chemical Equipment Co., 21 Center St., Los Angeles, Calif.—Leaflet describing chlorinators, ammonators, and water conditioning equipment.

Coatings. Americoat Div. of American Paint and Construction Co., P. O. Box 3428, Terminal Annex, Los Angeles 4, Calif.—4-page technical folder describing acid-resistant plastic coatings.

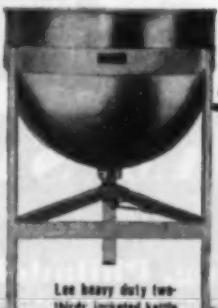
Coatings. Spencer Kellogg & Sons, Inc., Buffalo 5, N. Y.—Booklet giving the properties and uses of various types of oil coatings.

Coke Ovens. Wilputte Coke Oven Corp., 6 Rector St., New York 6, N. Y.—Catalog 6 describing the design, structural features and op-



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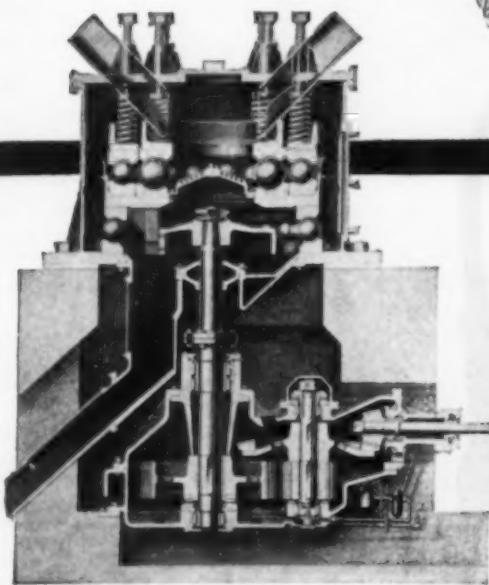
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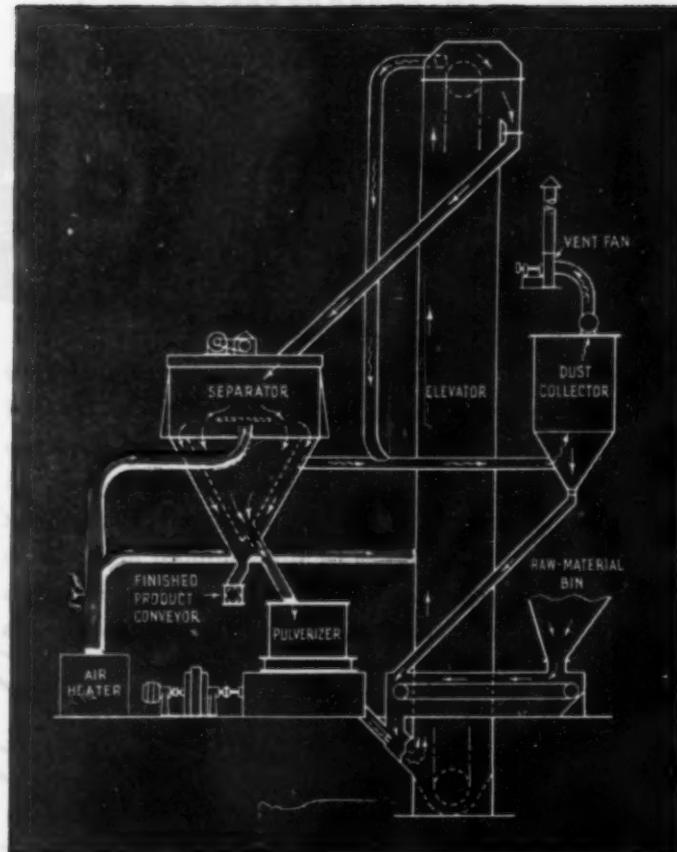
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Compressors. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.—19-page booklet illustrating many applications for compressed air. Form 1011. 16-page booklet describing K-1 gas-engine driven compressors built by this company.

Compressors. Worthington Pump & Machinery Corp., Harrison, N. J.—4-page folder illustrating three-stage high pressure air or gas compressors. Bulletin H-620 B25. 24-page bulletin describing the LFC angle four-cycle gas-engine compressor. Bulletin L-685-31.

Combustion Control. The North American Manufacturing Co., 2910 E. 75th St., Cleveland 4, Ohio—4-page folder showing the automatic control of fuel-air proportions in dual fuel-burning systems. Bulletin No. DF.

Condenser Tube Inlets. Condenser Service Engineering Co., Inc., Hoboken, N. J.—8-page booklet featuring Flowrite metal inserts for protection of condenser tube inlets against erosion.

Controls. B/W Controller Corp., Birmingham, Mich.—28-page catalog featuring electronic liquid level and industrial controls. Installation data and application diagrams are given. Catalog No. 145.

Conveyors. Chain Belt Co., 1600 W. Buena St., Milwaukee 4, Wis.—6-page folder showing construction details and capacities of bulk material conveyors. Bulletin No. 462.

Conveyors. Standard Conveyor Co., No. St. Paul, Minn.—24-page catalog illustrating types of conveyor equipment and how they are used in a number of industries. Catalog 308.

Cooling Towers. C. H. Wheeler Mfg. Co., Lehigh and Sedgley Aves., Philadelphia 32, Pa.—20-page catalog showing the various types of water cooling towers made by this company. Catalog No. 145.

Cotton Byproducts. Railway Supply & Mfg. Co., Rayco Linter Cotton Div., Cincinnati, Ohio—28-page illustrated booklet showing the products in which cotton linters are used as a material.

Counting Scales. The Howe Scale Co., Franklin, Vt.—Descriptive circular showing the varieties of counting scales and other products manufactured by this company. Circular P-1.

Electric Motors. Crocker-Wheeler Div., Joshua Hendy Iron Works, Ampere, N. J.—4-page folder illustrating the features of positive type squirrel-cage motors.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—16-page bulletin covering various kinds of process equipment. Bulletin No. B-166-C.

Equipment. American Locomotive Co., Products Div., 30 Church St., New York 6, N. Y.—16-page booklet showing prefabricated piping, pressure vessels and heat-exchange equipment manufactured by this company. Illustrations are used to give design, selection, and application data. Bulletin 1034.

Equipment. Whiting Corp., Harvey, Ill.—Five bulletins dealing with the suppression of dust, fumes and sparks from industrial plants. Bulletins No. FY-131, FY-132, FY-133, FY-134, FY-135.

Equipment. J. A. Zurn Mfg. Co., Erie, Pa.—12-page catalog describing a complete line of devices such as strainers and interceptors for protection of operating equipment in fluid-handling systems. Catalog No. 45.

Filter Presses. T. Shriver & Co., Inc., Harrison, N. J.—Detailed description of filter presses showing design, capacities, principles and methods of operation and application.

Fire Brick. Armstrong Cork Co., Lancaster, Pa.—8-page booklet describing five types of fire brick for temperatures up to 2,600 deg. F. Included is a description of various insulating cements.

Flashlight Batteries. B. F. Goodrich Co., Akron, Ohio—4-page technical article on rechargeable flashlight storage batteries. Bulletin No. 61.

Floors. The Belden Brick Co., Canton, Ohio—16-page illustrated brochure describing industrial acidproof brick floors. Acidproof cement used is said to be highly resistant to bacteria, heat, chemical and abrasive attacks.

Flow Meters. Hetherington & Berner, Inc., 701-745 Kentucky Ave., Indianapolis 7, Ind.—8-page illustrated booklet describing the Fluidos.

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eter automatic metering system for light or heavy liquids. The Fluidometer is used in batch processes. Bulletin F-44.

Fluorochromy. Ultra-Violet Products, Inc., 5205 Santa Monica Blvd., Los Angeles 27, Calif.—5-page article giving information on the fluorescent analysis of various chemicals, liquids and solids. Bulletin No. 1.

Fused Quartz. Ameril Co., Inc., 60 Wall Tower, New York 3, N. Y.—14-page booklet outlining the characteristics of Ameril (fused silica quartz) products.

Glass Linings. A. O. Smith Corp., Milwaukee 1, Wis.—16-page pictorial booklet featuring glass-lined tanks and water heaters. Bulletin No. 578.

Graphite. Acheson Colloids Corp., Port Huron, Mich.—Folder describing colloidal graphite dispersions and some of the potential uses for these products. Bulletin No. 440.

Graphite. National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.—20-page booklet describes and illustrates carbon and graphite construction materials used in various process industries. Charts and tables cover the physical and chemical properties together with application and operating data on these products. Catalog Section M-8000-A.

Heat Exchangers. Graham Mfg. Co., Inc., 415 Lexington Ave., New York 17, N. Y.—13-page illustrated booklet describing the Heliow heat exchanger. Bulletin 58.

Heat Exchangers. The Whitlock Mfg. Co., Hartford 1, Conn.—9-page booklet giving useful information on the care and handling of heat exchangers.

Heat Exchangers. Worthington Pump & Machinery Corp., Harrison, N. J.—8-page folder illustrating coolers used in mechanical refrigeration. Bulletin B-1100-B17.

Industrial Colors. The Arco Co., 731 Beusmer Ave., Cleveland 4, Ohio—Four booklets designed to provide a simple color selection guide to minimize fatigue and promote safety in industrial, institutional, and commercial interiors.

Industrial Lighting. Wabash Appliance Corp., Birdseye Lamp Sales Div., 345 Carroll St., Brooklyn 31, N. Y.—Booklet featuring a set of charts containing illumination values based on various spacing and mounting heights. Bulletin No. 1-545.

Instruments. The Esterline Angus Co., Inc., Indianapolis, Ind.—4-page folder describing industrial problems solved by recording instruments. Bulletin 642.

Instruments. Fischer & Porter Co., Hathersage, Pa.—8-page booklet describing the Rotastat flow-rate indicator and flow-rate alarm. Construction details, dimensions, capacities, prices, together with application data are given. Bulletin 92-C.

Instruments. Leeds & Northrup Co., 4901 Stanton Ave., Philadelphia 44, Pa.—25-page booklet describing the Micromax electric input controller. Catalog N-00A (2).

Instruments. Photovolt Corp., 95 Madison Ave., New York 16, N. Y.—5-page booklet describing the optical fluorescence comparator used in the quantitative analysis of fluorescent substances. Bulletin No. 370.

Instruments. Revere Co., Wallingford, Conn.—4-page folder illustrating pilot tubes and thermocouples used with gases and liquids. Bulletin No. 302.

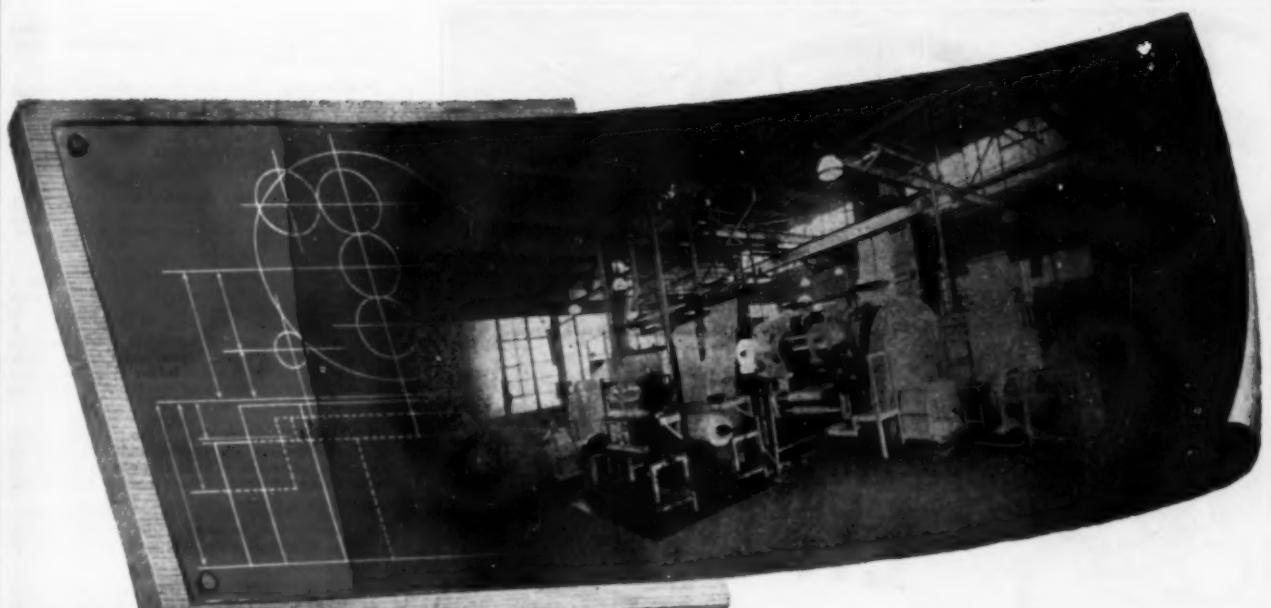
Instruments. Taylor Instrument Co., Rochester, N. Y.—8-page booklet describing the features and principle of operation of the Time Schedule controller. Bulletin 98165.

Materials Handling. Lewis-Shepard Products Inc., 300 Walnut St., Watertown 72, Mass.—76-page illustrated catalog describing the materials handling equipment offered by this company. Catalog No. 22.

Organic Chemicals. Emsulol Corp., 59 Madison St., Chicago, Ill.—60-page booklet describing surface-active chemicals and emulsions. Contains a ready-reference chart covering properties, specifications, and principal uses of various materials of this kind. Also given are useful excerpts from U. S. laws and regulations covering this type of chemical. Catalog No. 44.

Paint Guide. America-Marietta Co., 43 E. Ohio St., Chicago, Ill.—Method of selecting paints for a given application is provided by the Vakura Paint Guide slide rule.

pH Control. Burrell Technical Supply Co., 1936-42 Fifth Ave., Pittsburgh 19, Pa.—4-page



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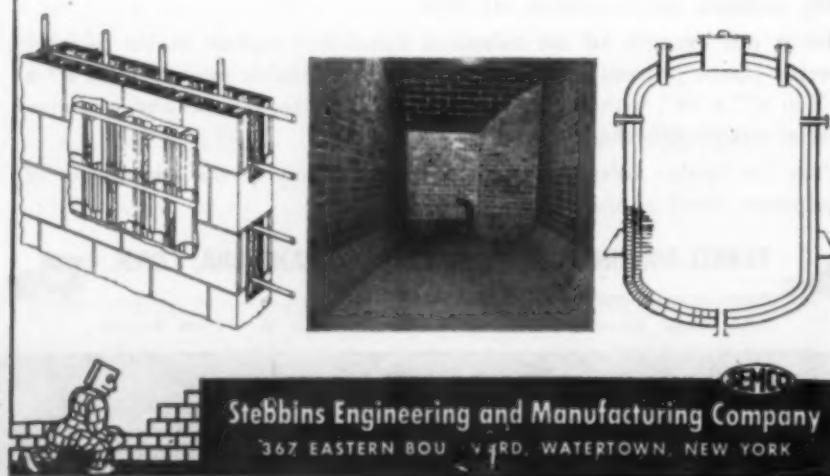


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leaflet featuring Coleman certified buffer tablets used for standardizing pH electrometers. Catalog Section B-205.

Plasticizers. Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York 17, N. Y.—16-page booklet giving essential information on various plasticizers. Names, formulas, physical properties, specifications, and suggested uses of these products are given.

Plastics. Hercules Powder Co., Wilmington, Del.—20-page booklet illustrating the properties of cellulosic thermoplastics made by this company.

Process Equipment. Worthington Pump & Machinery Corp., Harrison, N. J.—20-page catalog outlining this company's equipment for the process industries. Bulletin WD-1099-B317. 4-page folder describing complete CO₂ plant in production of CO₂ gas, liquid and dry ice. Bulletin C-1100-B24. 6-page folder describing filter presses and wax barreling machines built by this company. Bulletin C-1100-B25.

Pumps. Blackmer Pump Co., Grand Rapids 9, Mich.—6-page illustrated folder showing the operating principle of this company's bucket design (swinging vane) rotary pump. Bulletin 306.

Pumps. Bump Pump Co., LaCrosse, Wis.—104-page catalog describing the principles of operation, range of sizes, etc., of this company's line of pumps.

Pumps. Byron Jackson Co., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif.—13-page illustrated booklet describing deep well pumps. Brief specifications with pump sizes and capacities are also given. Bulletin No. 44-500. Also 8-page booklet giving construction details of a vertical multi-stage pump for handling a wide variety of industrial liquids. Bulletin No. 44-4620.

Pumps. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.—20-page catalog describing centrifugal pumps for various applications in pulp and paper mills. Bulletin 7022.

Pumps. Roots-Countersville Blower Corp., Countersville, Ind.—4-page folder illustrating various blowers and gas pumps. Pumps and blowers used in particular industries are shown. Bulletin No. G-81-D.

Pumps. George D. Roper Corp., Rockford, Ill.—31-page booklet designed to aid engineers and service men in the handling of pumping problems. Much useful technical information is given, including a number of tables and graphs.

Pumps. Sier-Bath Gear Co., Inc., North Bergen, N. J.—8-page booklet describing screw pumps for use in handling liquids and semi-liquids. Features of this pump are given with installation and maintenance hints. Tables and charts show capacities, dimensions, and operating data.

Pumps. Stewart-Warner Corp., Alemite Div., 1826 Diversey Parkway, Chicago, Ill.—8-page folder describing the Alemite "Versatal" pump for paints, sealers, and mastics. Principal features of this air-operated high-pressure pump are illustrated and described.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—6-page booklet describing this company's horizontal direct-acting positive pump. Bulletin W-113-632.

Pulp Washers. Swenson Evaporator Co., Harvey, Ill.—8-page bulletin describing the outstanding features of the Swenson-Nyman line of pulp washers. Bulletin F-104.

Refractories. A. P. Green Fire Brick Co., Mexico, Mo.—Booklet describing Kast-O-Lite, the insulating castable refractory made by this company.

Refrigeration. Worthington Pump & Machinery Corp., Harrison, N. J.—8-page booklet describing absorption refrigerating machines. Bulletin B-1100-B8.

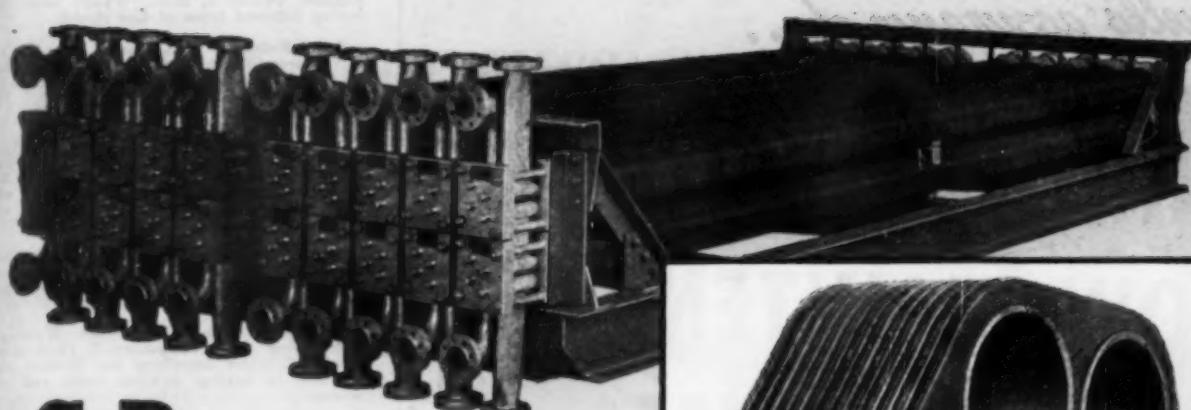
Resins. Neville Co., Neville Island, Pittsburgh 25, Pa.—82-page booklet giving the characteristics and uses of resins and plasticizers made by this company.

Roof Slabs. Federal Cement Tile Co., 6085 Dearborn St., Chicago 5, Ill.—4-page illustrated folder showing precast concrete insulated roof slabs produced by this company.

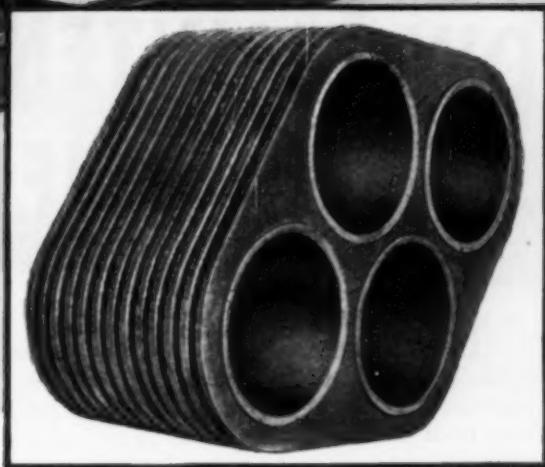
Rubber Gloves. B. F. Goodrich Co., Akron, Ohio—4-page folder describing all-synthetic industrial rubber gloves. Catalog Section No. 900.

Safety Clothing. American Optical Co., Southbridge, Mass.—Booklet describes and lists various kinds of safety clothing for male workers.

Safety Shields. The Boyer-Campbell Co., Allentown, Pa.—Booklet describes and lists various kinds of safety shields for male workers.



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Antoine, Detroit 2, Mich.—4-page folder illustrating different types of face shields.

Speed Reducers. D. O. James Mfg. Co., 110 W. Monroe St., Chicago, Ill.—Complete catalog set showing the various types of speed reducers and gears manufactured by this company. Price lists are included. Catalog No. 1000R.

Speed Reducers. Philadelphia Gear Works Inc., Erie Ave. & C St., Philadelphia 34, Pa.—6-page illustrated booklet describing spiral bevel speed reducers. Various tables are given which show dimensions, ratings, capacities and other useful data. Bulletin No. 200.

Steam Boilers. The International Boiler Works Co., East Stroudsburg, Pa.—6-page folder outlines salient features of this company's steam generators.

Steam Jets. The Youngstown Welding & Engineering Co., Youngstown 9, Ohio—8-page illustrated folder describing the Weldco steam jet used in heating pickling tanks and other processes.

Steam Jet Ejectors. Graham Manufacturing Co., Inc., 415 Lexington Ave., New York 17, N. Y.—34-page illustrated booklet describing steam jet ejectors. Contains performance curves and tables of sizes and dimensions. Operation and maintenance information is given. Bulletin No. 56.

Steel Castings. American Steel Castings Co., Newark, N. J.—4-page folder giving the analysis, physical properties, and application for the corrosion- and heat-resisting steel castings produced by this company.

Stokers. American Engineering Co., Philadelphia 25, Pa.—8-page bulletin describing the AE Perfect Spread Stoker and a 20-page booklet showing the Type R Taylor multiple-retort underfeed stoker.

Stress Reduction. The Osborn Mfg. Co., 540 Hamilton Ave., Cleveland, Ohio—4-page technical report on reducing concentration of stress by removing sharp edges, burrs, and grinding marks with wire brushes.

Synthetic Waxes. The Glyco Products Co. Inc., 26 Court St., Brooklyn 2, N. Y.—16-page bulletin giving information on high melting point synthetic waxes produced by this company.

Tachometers. Herman H. Sticht Co., Inc., 2 Park Place, New York, N. Y.—4-page folder describing triple-range centrifugal type tachometers. Bulletin No. 760.

Thermometers. Gotham Instrument Co., 10 Wooster St., New York 12, N. Y.—32-page catalog describing Gotham indicating, recording and controlling thermometers. Section on manufacture and personnel starts the book. Full-page illustrations show actual sizes and list specifications. Many illustrations and exhaustive information included. Catalog No. 45.

Thermostats. United Electric Controls Co., 69-71 A St., Boston 27, Mass.—4-page folder featuring the Type K industrial thermostat made by this company. Bulletin 441-T.

Transformers. General Electric Co., Schenectady, N. Y.—Three illustrated booklets giving complete information on Pyranol transformers.

Tubing. Bridgeport Brass Co., Bridgeport 2, Conn.—8-page folder illustrating application and methods of installing duplex ply-metal tubing.

Vacuum Pumps. C. H. Wheeler Mfg. Co., Lehigh and Sedgley Ave., Philadelphia 32, Pa.—4-page pamphlet on tube jet vacuum pump of the steam jet ejector type. Special, standard and marine pumps illustrated. Bulletin No. 944.

Valves. A. W. Cash Valve Mfg. Co., Decatur, Ill.—28-page descriptive catalog featuring detailed information and data on the complete line of Cash-Acme automatic valves and pressure controls for use with water, air, steam, and oil.

Valves. American Car & Foundry Co., 30 Church St., New York 8, N. Y.—8-page folder describing the ACF full-pipe-area lubricated plug valves for handling all types of industrial fluids. Model sizes and ordering information are given. Bulletin CC-5M-145.

V-Belts. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—12-page catalog covering V-belt drives. Included are important features, selection tables, performance data, prices, etc. Catalog No. B-6051-E.

X-Ray. Picker X-Ray Corp., 300 4th Ave., New York 10, N. Y.—16-page bulletin covering Picker X-ray inspection equipment. Includes descriptions of inspection cabinet, exposure tray, tube carriage, fluoroscopic chamber. Diagrammatic drawings show dimensional data.

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

PRODUCTION OF CHEMICALS CONTINUES TO MOVE AHEAD DESPITE RETARDING FACTORS

PRODUCTION of chemicals so far this year has been adversely affected by the prevalence of unusually severe weather conditions which, in some sections, has slowed plant operations, delayed the movement of raw materials and finished products, and interfered with transportation generally by tying up freight and tank cars. More recently, some sections have been affected by flood conditions which brought further complications in production schedules. However, the trend of chemical outputs has been upward. The index of the Federal Reserve Board measures chemical production for January at 316 as against 313 for December and for industrial chemicals the January index is 397 or a full point advance over the December figure.

Most important in maintaining the favorable over-all position of chemicals are the high rates of operation reported for ammunition plants, for oil refineries, and for synthetic rubber production. Each one of these industries accounts for the disappearance of large tonnages of chemical products and new capacities for producing high octane gasoline have widened consumption of chemicals in that field with new records for output now being recorded. The stepping up of aerial and land operations on the European sector has increased requirements for ammunition and, if continued, will defer the time when stockpiles will be large enough to warrant a curtailment in production.

In view of improved prospects for an early termination of the struggle in Europe, it is timely to refer to our economic prospects for 1945 as set forth in a study made by the Department of Commerce. In part this review states that if the war in Europe should end fairly early this year a great deal of the tension under which our economy is operating would be released. The fundamental factor would be a substantial curtailment of munitions production with the possibility of some reduction in the size of the armed forces and of the military drain on civilian-type goods. Under these conditions a decline in production volumes is a virtual certainty. The shift from war to civilian production also would indicate a drop in output but the review emphasizes that in that period, business conditions will be exceptionally good even though there will be some contraction in outputs. So long as the war in the Far East continues, the volume of government expenditures will remain high and, in conjunction with the deferred demand for both consumption and capital goods of various types, will assure favorable business volume. Total production will

not be maintained with any substantial reduction in munitions output unless measures are taken beforehand to shift the released resources to other uses.

Industrial consumption of chemicals has made a favorable showing since the turn of the year although the same unfavorable factors of weather and floods have been encountered. Many chemicals remain in short supply and civilian use in different cases has been curtailed by government orders in recent weeks but offsetting factors are present and there is nothing at present to indicate any widespread upsets. Paint manufacturers have been hit rather hard because several of the scarce chemical products are basic in paint manufacture and while military requirements for paints will be taken care of, the amounts made available for general consumption promise to be far below normal requirements.

The Chem. & Met. index for industrial consumption of chemicals shows January

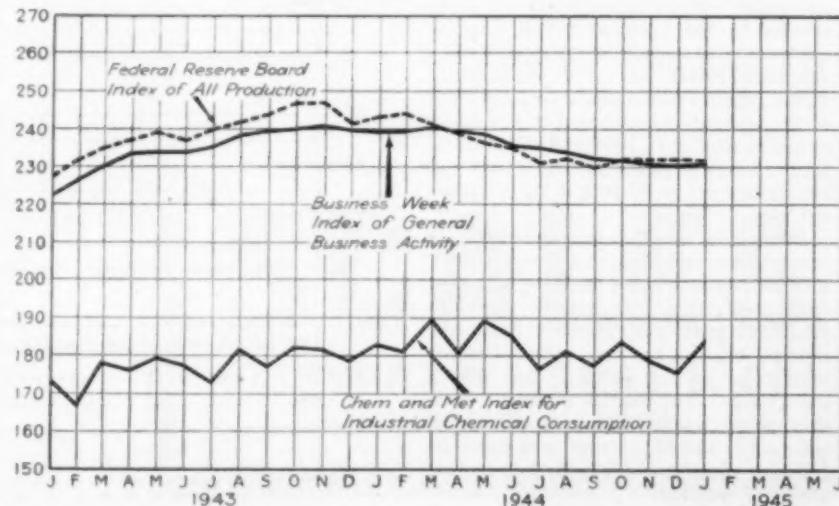
established at 185.74 compared with a revised figure of 175.74 for December. These indexes for comparable months of the preceding year were 182.74 and 178.45 respectively. The index for the final quarter of 1944 was 179.45 and this should be topped in the first quarter of this year and the average for the first quarter may also move a little higher than the 184.45 which records activities for the 1944 quarter.

The channeling of chemicals in greater volume to fit in with military needs is bringing corresponding changes in industries turning out goods for civilian use. A typical case is found in the anti-freeze trade. Already announcement has been made that no methanol will be made available for anti-freeze use in the 1945-46 season. The methanol is urgently needed in the manufacture of formaldehyde for munitions and for plastics, important in the military program. There are sufficient amounts of permanent type anti-freeze materials in sight to fill all needs, both military and civilian. Hence the methanol will go where it is badly needed but anti-freeze requirements will not suffer.

Plant expansions have been discussed as a means for overcoming the shortage of some urgently needed chemicals but this would not serve the purpose if raw materials were not found to keep the proposed plants in operation. This has been pointed out in respect to phthalic anhydride. Military demands for this chemical have increased to a point where they can not be met even with no reservations for general use. It has been estimated that military demands for the first quarter of this year reach a total of more than 50,000,000 lb. while production is not expected to reach 35,000,000 lb. The difficulty in raising production is as much concerned with getting the raw materials as with productive facilities.

Chem. & Met. Index for Industrial Consumption of Chemicals
1935 = 100

	Dec. revised	Jan.
Fertilizers	38.31	41.40
Pulp and paper	17.90	18.75
Petroleum refining	18.80	18.63
Glass	18.50	19.40
Paint and Varnish	14.39	17.44
Iron and steel	13.35	13.07
Rayon	17.30	18.45
Textiles	10.18	11.18
Coal products	10.06	9.90
Leather	4.25	4.45
Industrial explosive	4.80	5.12
Rubber	3.00	3.00
Plastics	4.90	4.95
	175.74	185.74



PRODUCTION AND CONSUMPTION TRENDS

TRENDS in the producing and consuming branches of the chemical industry are decidedly mixed. Production of rubber chemicals as well as of synthetic rubber has been speeded up to keep pace with the large output of heavy tires which has increased 46 percent since last October. The March rate for tire production, however, has been slower because shortage of materials, especially tire cord and carbon black, resulted in releasing tire workers from their pledge to operate on a seven-day week basis and a six-day schedule was adopted for March.

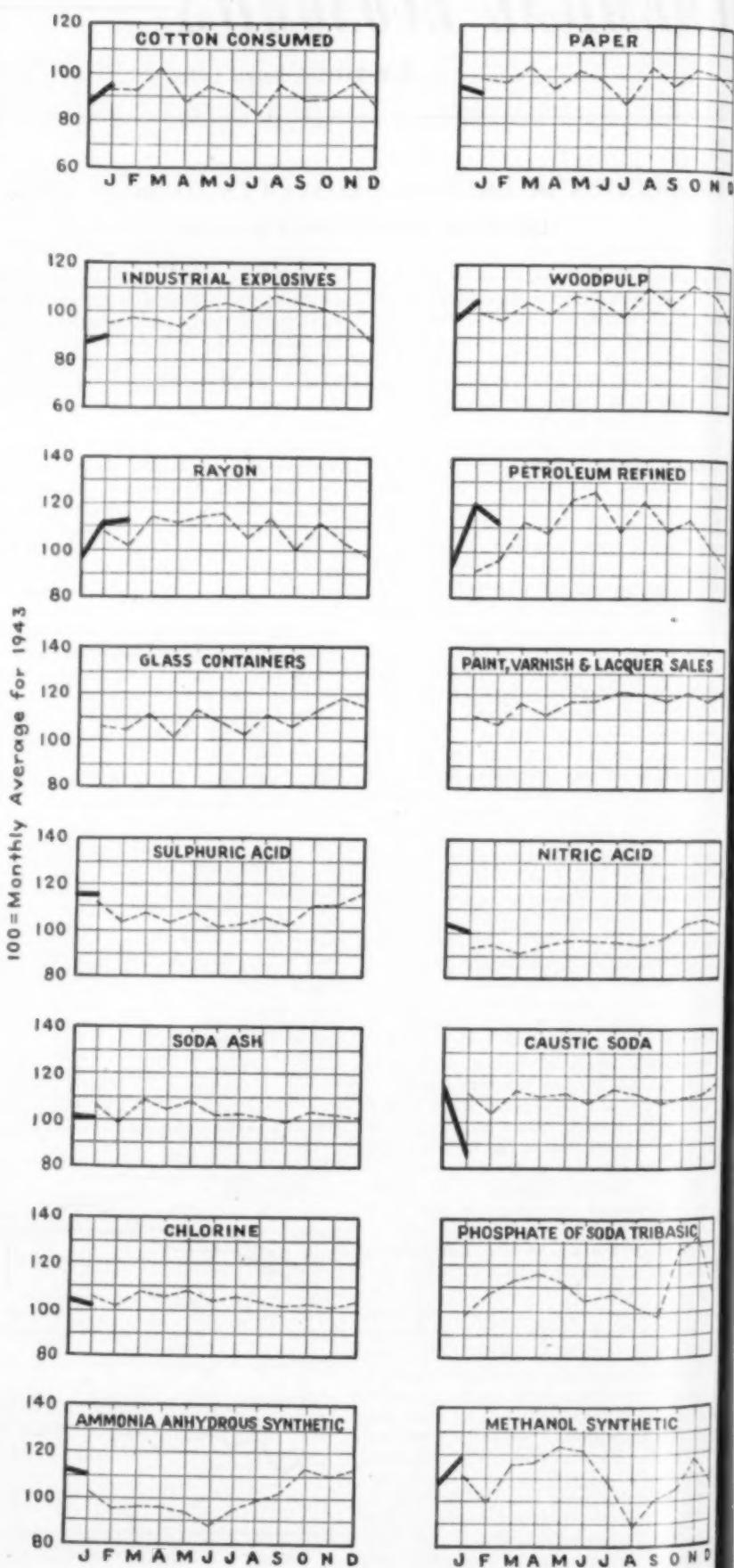
Current demand for tire cord runs above our capacities to turn out the product and while more cotton is expected to be used, it seems probable that early adjustment will be made at rayon plants whereby a larger part of plant facilities will be turned over to high tenacity yarn manufacture.

Carbon black, in the grades suitable for use outside the rubber industry, is freely available but compressed blacks are very scarce and even with new production to come into operation, the prospective supply is not adequate and recourse must be had to utilizing at least a relatively small part of the less desirable grades.

With a continuance of the pressure placed on glass to absorb a large share of packaging requirements, container manufacturers have been asked to push outputs above the record breaking level reached last year. Labor and other manufacturing difficulties will make it difficult to create a new high for container production but it is expected that this year's total will be close to the 1944 figure which is assurance that glass plants will operate at a high level with plate glass contributing more than last year to the grand total.

Production of rosin dropped steadily last year with the final quarter giving a supply of only 347,559 drums as compared with 358,407 drums in the comparable quarter of 1943. Stocks at the end of the year had fallen to 572,839 drums as against 973,431 drums at the end of 1943. The drop in inventories combined with the lowering trend of production forced rosin into the list of materials under allocation control and many manufacturing lines have been affected by the establishment of industry quotas which, outside of preferred orders, drastically curtail the use of rosin in industry. Soap makers are cut to 25 percent of the amount of rosin used in the corresponding quarter of 1944 and other industries, including paint, linoleum, and adhesives, are cut to 30 percent of last year's use.

Insecticide manufacturers anticipate an active season and some of the newer products are reported to be receiving active inquiry. A large carryover of arsenicals predicates some curtailment in new production and this has been reflected in the market for arsenic which is now offered more freely. The position of arsenic, however, could change suddenly if military requirements should increase or if some infestation should make inroads into current stocks of arsenicals.



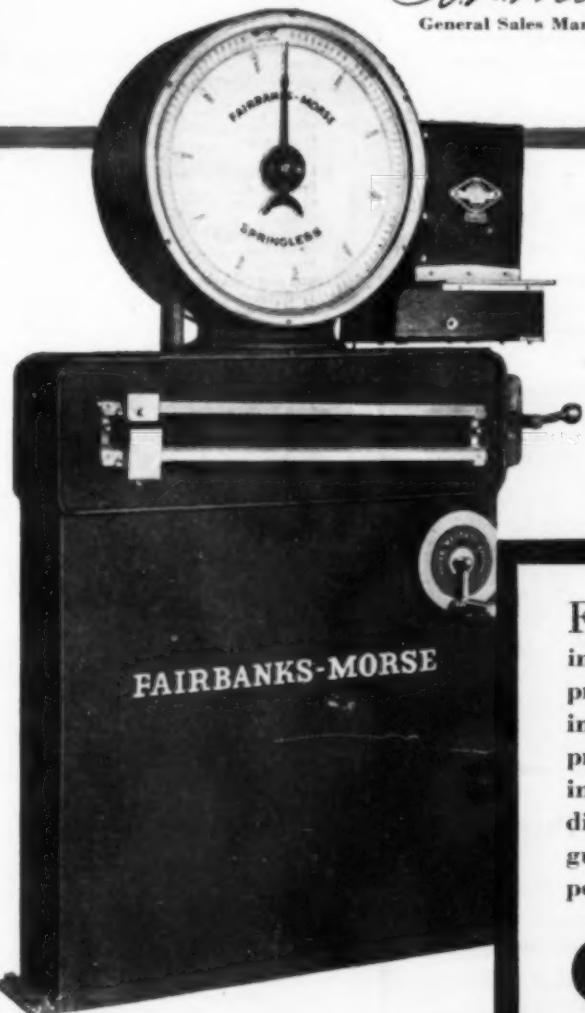
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General Sales Manager



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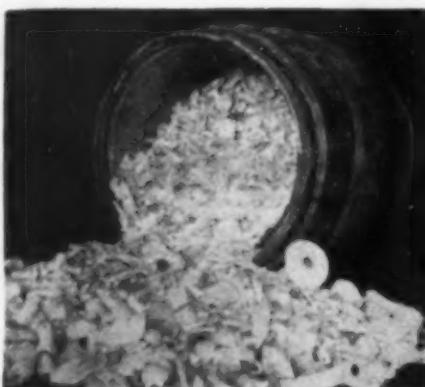
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WRITE FOR BULLETIN NO. 12

THE THERMAL SYNDICATE, LTD.

12 EAST 46th STREET

NEW YORK 17, N. Y.



Synthetic Organic Chemicals

December 1944 and Totals for 1944

Item	December	Total 1944
Acetanilide		
Production	4,670,812	
Consumption	1,831,088	
Stocks	373,088	373,088
Acetic acid (synthetic) ¹	34,701,553	291,953,913
Production	19,724,825	208,669,171
Consumption	7,630,408	7,636,408
Stocks		
Acetic acid (natural) ²	3,239,971	40,489,764
Production		
Stocks	1,486,345	1,486,345
Acetyl anhydride ³		
Production	43,809,066	493,654,126
Consumption	33,119,775	378,547,281
Stocks	12,106,161	12,106,161
Acetylalicylic acid		
Production	845,689	9,256,866
Stocks	980,284	980,284
n-Butyl acetate		
Production	5,833,809	69,758,499
Stocks	3,044,207	3,044,207
Cresote oil, tar distillers ⁴		
Production	10,813,363	121,149,971
Consumption	650,310	9,785,877
Stocks	9,943,840	9,943,840
Cresote oil, byproduct ^{5,6}		
Production	3,420,784	41,425,386
Consumption	21,130	852,981
Stocks	767,701	767,701
Cresote, meta-par ⁷		
Production	735,683	7,072,828
Consumption		1,178,188
Stocks	412,678	412,678
Cresols, ortho-meta-para ⁸		
Production	654,067	9,810,899
Stocks	163,860	163,860
Crolylic acid, crude		
Production	2,375,196	25,726,113
Stocks	890,484	890,484
Crolylic acid, refined		
Production	3,076,888	40,725,386
Stocks	1,064,161	1,064,161
Diethyl ether (all grades)		
Production	6,873,034	68,756,881
Stocks	4,505,445	4,505,445
Ethyl acetate (85 percent)		
Production	9,851,538	108,181,442
Consumption	1,268,375	18,213,700
Stocks	6,240,742	6,240,742
Lactic acid (edible)		
Production	317,476	3,583,455
Stocks	168,445	168,445
Lactic acid (technical)		
Production	682,786	4,217,062
Consumption	20,910	195,018
Stocks	291,339	291,339
Methyl chloride (all grades)		
Production	2,316,554	24,635,856
Stocks	426,121	426,121
Naphthalene (coke-oven) ^{9,10}		
Production	8,032,656	102,638,966
Stocks	2,060,215	2,060,215
Naphthalene (tar distillers) ¹¹		
Production	18,005,189	263,095,329
Stocks	7,251,964	7,251,964
Naphthalene, refined ¹¹		
Production	6,216,754	82,138,038
Consumption	4,666,550	55,633,912
Stocks	2,091,233	2,091,233
Oxalic acid (technical)		
Production	1,025,357	17,981,586
Stocks	311,210	311,210
Phenobarbital and sodium salts		
Production	13,776	234,074
Consumption		63,940
Stocks	41,924	41,924
Phthalic anhydride		
Production	10,778,529	124,063,844
Consumption	3,966,338	38,994,767
Stocks	1,749,103	1,749,103
Riboflavin (for human use)		
Consumption	865	35,081
Stocks	35,081	35,081
Sulfa drugs ¹²		
Production	350,925	4,567,086
Consumption		909,871
Stocks	798,193	798,193

Statistics collected and compiled by the U. S. Tariff Commission, except where noted. In pounds, except that creosote oil is expressed in gallons. Where no figures are given, data are confidential. ¹ Excludes recovered acetic acid. ² Acetic acid produced by direct process from wood and from calcium acetate. Compiled by Bureau of Census. ³ Includes anhydride from acetic acid by vapor-phase process. ⁴ Product of distillers who use purchased coal tar only. ⁵ Product of hydروproduct coke-oven operators only. ⁶ Statistics collected and compiled by Coal Economics Division, U. S. Bureau of Mines. ⁷ Statistics reported by hydروproduct coke-oven operators combined with those reported by tar distillers to prevent disclosure of operations of individual companies. ⁸ 11-month total. Production for June not revealed. ⁹ Statistics combine three grades solidifying at less than 74, 74 to less than 76, and 76 to less than 79 deg. C. ¹⁰ Production for sale only in case of less than 74 grade. Production both for consumption within producing plant and for sale in case of other two grades. ¹¹ 79 deg. C. and over. ¹² Includes data for acetylulfathiazole, both as drug and as intermediate, resulting in appreciable unavoidable duplication.

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Carbon, Graphite, or
"Karbate" materials, of course!

NATIONAL CARBON COMPANY, INC.

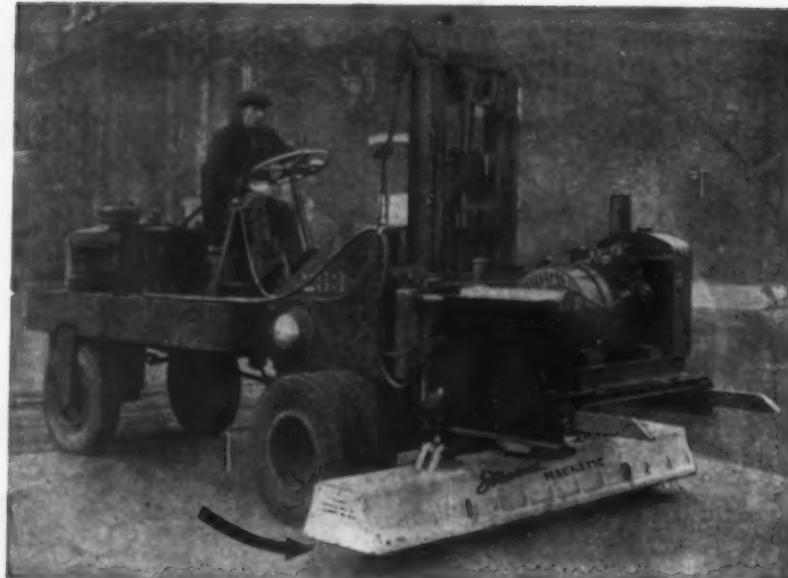
Unit of Union Carbide and Carbon Corporation



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Stearns

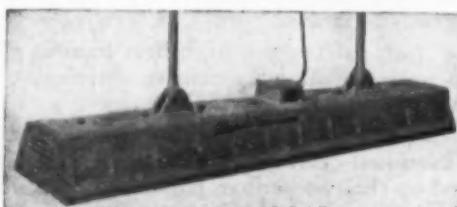
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629 So. 28th Street, Milwaukee, Wis.

CHEM. & MET.

Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	108.33
Last month	108.84
March, 1944	109.49
March, 1943	108.85

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to March 13.

INDUSTRIAL CHEMICALS

Acetone, tanks, lb.	\$0.07
Acid, acetic, 28%, bbl., 100 lb.	3.38 - \$3.63
Boric, bbl., ton	109.00 - 113.00
Citric, kegs, lb.	.20 - .23
Formic, obya, lb.	.10 - .11
Hydrofluoric, 30%, drums, lb.	.08 - .085
Lactic, 44%, tech, light, bbl., lb.	.073 - .075
Muriatic, 18%, tanks, 100 lb.	1.06 -
Nitric, 36%, carboys, lb.	.05 - .055
Oleum, tanks, wka., ton	18.50 - 20.00
Oxalic, crystals, bbl., lb.	.11 - .12
Phosphoric, tech., tanks, lb.	.04 -
Sulphuric, 60%, tanks, ton	13.00 -
Tartaric, powd., bbl., lb.	.70 -
Alcohol, amy...	
From pentane, tanks, lb.	.131 -
Alcohol, butyl, tanks, lb.	.101 - .18
Alcohol, ethyl, denatured, 190 proof:	
No. 1 special, tanks, gal., wka.	.50 -
Alum, ammonium, lump, bbl., lb.	.04 -
Aluminum sulphate, com. bags, 100 lb.	1.15 - 1.40
Ammonia, anhydrous, cyl., lb.	.14 -
Ammonium carbonate, powd., tech., casks, lb.	tanks, ton. 59.00 - 69.00
Amyl acetate, tech., from pentane, tanks, lb.	.004 - .12
Sulphate, wka., ton	28.20 -
Amyl acetate, tech., from pentane, tanks, lb.	.145 -
Aqua ammonia, 26%, drums, lb.	.021 -
Arsenic, white, powd., bbl., lb.	tanks, ton. .04 - .04
Barium carbonate, bbl., ton	65.00 - 75.00
Chloride, bbl., ton	.75.00 - 78.00
Nitrate, casks, lb.	.09 - .11
Blane fix, dry, bags, ton	60.00 - 70.00
Bleaching powder, f.o.b., wka., drums, 100 lb.	2.50 - 3.00
Borax, gran, bags, ton	45.00 -
Calcium acetate, bags	3.00 -
Arsenate, dr., lb.	.071 - .08
Carbide, drums, ton	.50.00 -
Chloride, fake bags, del., ton	18.50 - 25.00
Carbon bisulphide drums, lb.	.05 - .05
Tetrachloride drums, gal.	.73 - .80
Chlorine, liquid, tanks, wka., 100 lb.	1.75 - 2.00
Copperas, bags, f.o.b., wka., ton	17.00 - 18.00
Copper carbonate, bbl., lb.	.194 - .20
Sulphate, bbl., 100 lb.	.50 - 5.50
Cream of tartar, bbl., lb.	.57 -
Diethylene glycol, dr., lb.	.141 - .15
Epsom salt, dom., tech., bbl., 100 lb.	1.80 - 2.00
Ethyl acetate, tanks, lb.	.11 -
Formaldehyde, 40%, tanks, lb.	.032 -
Furfural, tanks, lb.	.004 -
Glauber's salt, bags, 100 lb.	1.02 - 1.10
Glycerine, e.p., drums, extra, lb.	.154 - .16
Lead:	
White, basic carbonate, dry, casks, lb.	.68 -
Red, dry, sol., lb.	.09 -
Lead acetate, white crys., bbl., lb.	.12 - .13
Lead acetate, powd., bag, lb.	.11 - .12
Lithopone, bags, lb.	.04 - .04
Magnesium carb., tech., bags, lb.	.06 - .06
Methanol, 98%, tanks, gal.	.58 -
Synthetic, tanks, gal.	.24 -
Phosphorus, yellow, cases, lb.	.23 - .25
Potassium bichromate, casks, lb.	.10 - .10
Chlorate, powd., lb.	.001 - .12
Hydroxide (e'stic potash) dr., lb.	.07 - .07
Muriate, 60%, bags, unl.	.53 -
Nitrate, bbl., lb.	.05 - .06
Permanganate, drums, lb.	.10 - .20
Prussiate, yellow, casks, lb.	.16 - .17
Sal ammoniac, white, casks, lb.	.0515 - .06
Salsoda, bbl., 100 lb.	1.00 - 1.00
Salt cake, bulk, ton.	15.00 -
Soda ash, light, 55%, bags, contract, 100 lb.	1.05 -
Dense, bags, 100 lb.	1.15 -
Soda, caustic, 76%, solid, drums, 100 lb.	2.30 - 3.00
Acetate, das., bbl., lb.	.05 - .06
Bicarbonate, bbl., 100 lb.	1.70 - 2.00
Bichromate, casks, lb.	.074 - .084
Bisulphite, bulk, ton	16.00 - 17.00
Bisulphite, bbl., lb.	.03 - .04

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WeldOlets are made in size-to-size and reducing sizes for standard pipe sizes up to 24" and for pressures up to 400 lbs. at 750°. Men responsible for piping will want to know more about the WeldOlet method of making branch pipe outlets. Illustrated catalog with complete application and installation information will be sent on request.

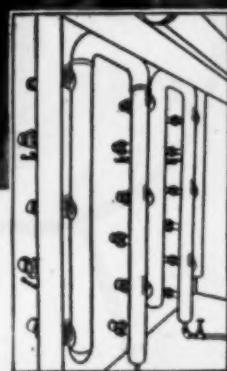


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WeldOlets played an important part in the installation shown here. This is part of the air conditioning system in one of the largest federal buildings.



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For Welded Branch Pipe Outlets

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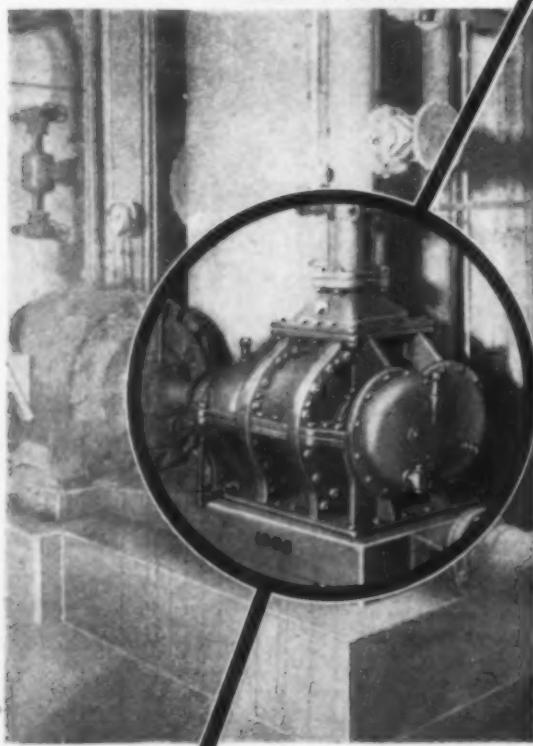
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Capacities from 5 to 10,000 CFM, vacuums up to 25" Hg.

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503 Illinois Ave. Connersville, Indiana



POSITIVE DISPLACEMENT

The principle is simple and effective. Twin impellers are rotated in opposite directions by a pair of timing gears. Each impeller alternately sucks in, momentarily entraps, and then expels a definitely measured amount of air or gas, resulting in the evacuation of four equal, predetermined volumes each revolution of the drive shaft. Capacity varies with the speed. Impellers need no seal or lubrication. Suction is automatically built up to overcome resistance on the inlet or vacuum side. The action is continuous, with a resultant steady vacuum.

"R-C" Vacuum Pump installed in chemical plant. At 870 RPM it maintains 25" Hg. vacuum; handles 52 lbs. ammonia liquor, 1,465 lbs. water with trace of caustic soda, and 6,000 cu.ft. of "free air" per hour.



CHEM. & MET.

Weighted Index of Prices for

OILS & FATS

Base = 100 for 1937

This month	145.8
Last month	145.8
March, 1944	145.5
March, 1943	141.8

Chlorate, kegs, lb.	.061 - .09
Cyanide, cases, dom., lb.	.141 - .15
Fluoride, bbl., lb.	.07 - .08
Hypophosphite, bbl., 100 lb.	2.40 - 2.50
Metasilicate, bbl., 100 lb.	2.50 - 2.65
Nitrate, bulk, 100 lb.	1.35 - .35
Nitrite, cases, lb.	.061 - .07
Phosphate, tribasic, bags, lb.	3.70 - .091
Prumate, yel., bags, lb.	.80 - .85
Silicate, 40P, dr., wks., 100 lb.	.021 - .021
Sulphide, bbl., lb.	.021 - .021
Sulphite, crys., bbl., lb.	.021 - .021
Sulphur, crude at mine, long ton.	16.00 - .07
Dioxide, cyl., lb.	.07 - .08
Tin crystals, bbl., lb.	.39 - .39
Zinc chloride, gran., bbl., lb.	.051 - .06
Oxide, lead free, bag, lb.	.071 - .071
Oxide, 5% leaded, bags, lb.	.071 - .071
Sulphate, bbl., cwt.	3.85 - 4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb.	\$0.131 - \$0.14
Chinawood oil, tanks, lb.	.381 - .385
Cocoonut oil, ceylon, dr. N. Y., lb.	.0885 - .0885
Corn oil crude, tanks (f.o.b. mill), lb.	.121 - .121
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.121 - .121
Linseed oil, raw, car lots, bbl., lb.	.155 - .155
Palm, cases, lb.	.0865 - .0865
Peanut oil, crude, tanks (mill), lb.	.13 - .13
Rapeseed oil, refined, bbl., lb.	nom.
Soybean, tank, lb.	.111 - .111
Menhaden, light pressed, dr., lb.	.125 - .125
Crude, tanks (f.o.b. factory), lb.	.080 - .080
Grease, yellow, loose, lb.	.081 - .081
Oleo stearine, lb.	.09 - .09
Oleo oil, No. 1, lb.	.111 - .111
Red oil, distilled, bbl., lb.	.121 - .121
Tallow extra, loose, lb.	.081 - .081

COAL-TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb.	\$0.82 - \$0.55
Alpha-naphthylamine, bbl., lb.	.32 - .34
Aniline oil, druma, extra, lb.	.15 - .16
Aniline, mala, bbl., lb.	.22 - .24
Benzaldehyde, U. S. P., dr., lb.	.85 - .86
Bensidine base, bbl., lb.	.70 - .75
Benzoinic acid, U. S. P., kegs, lb.	.54 - .56
Benzol, 90%, tanks, works, gal.	.15 - .15
Benzyli chloride, tech., dr., lb.	.23 - .25
Beta-naphthol, tech., druma, lb.	.23 - .24
Cresol, U. S. P., dr., lb.	.11 - .11
Cresylic acid, dr., wks., gal.	.81 - .81
Diphenyl, bbl., lb.	.15 - .15
Diethylaniline dr., lb.	.40 - .45
Dinitrotoluol, bbl., lb.	.18 - .18
Dinitrophenol, bbl., lb.	.22 - .22
Dip oil, 15%, dr., gal.	.23 - .25
Diphenylamine, dr. f.o.b. wks., lb.	.60 - .60
H, acid, bbl., lb.	.45 - .50
Hydroquinone, bbl., lb.	.90 - .90
Naphthalene, flake, bbl., lb.	.07 - .07
Nitrobenzene, dr., lb.	.08 - .08
Paracresol, bbl., lb.	.41 - .41
Para-nitroaniline, bbl., lb.	.47 - .49
Phenol, U. S. A., druma, lb.	.101 - .111
Pieric acid, bbl., lb.	.35 - .35
Pyridine, dr., gal.	.170 - .180
Resorcinol, tech., kegs, lb.	.75 - .75
Salicylic acid, tech., bbl., lb.	.26 - .26
Solvent naphtha, w.w., tanks, gal.	.27 - .27
Tolidine, bbl., lb.	.96 - .96
Toluol, druma, works, gal.	.33 - .33
Xylool, com., tanks, gal.	.26 - .26

MISCELLANEOUS

Cassin, tech., bbl., lb.	\$0.18 - \$0.34
Dry colors	
Carbon gas, black (wks.), lb.	.0335 - .35
Prussian blue, bbl., lb.	.06 - .27
Ultramarine blue, bbl., lb.	.11 - .28
Chrome green, bbl., lb.	.23 - .23
Carmine, red, tins, lb.	.40 - .45
Para tone, lb.	.75 - .75
Vermilion, English, bbl., lb.	2.75 - 2.80
Chrome, yellow, C. P., bbl., lb.	.16 - .17
Gum copal; congu, bags, lb.	.00 - .00
Manila, bags, lb.	.00 - .15
Damar, Batavia, cases, lb.	.10 - .10
Kauri, cases, lb.	.18 - .18
Magnesia, calo, ton.	.04.00 - .04.00
Pumice stone, lump, bbl., lb.	.05 - .05
Rosin, 100 lb.	.6.71 - .6.71
Shellac, orange, fine, bags, lb.	.39 - .39
Bleached, bonyd, bags, lb.	.39 - .39
T.N. bags, lb.	.31 - .31
Turpentine, gal.	.901 - .901



**FACT
NO. 1**

Hammond Multi-Wall Bags are *economical*. First cost is the *only* cost. No handling, cleaning, storage or freight charges on "returned containers." No "returned bag" nuisance.

**FACT
NO. 2**

Hammond Multi-Wall Bags are *sanitary*. They provide adequate protection against insect infestation, dirt, cinders, etc., assuring content purity and cleanliness. Also sift proof to keep the product "in" and the dirt "out."

**FACT
NO. 3**

Hammond Multi-Wall Bags are *strong*. They are built to stand rough handling and to "deliver the goods" without loss or damage.

**FACT
NO. 4**

Hammond Multi-Wall Bags are *weather-proof*. Rain, snow, sleet and leaky cars hold no terrors for shippers of these containers. Special *moisture-proof plies* for products requiring extra protection.

**FACT
NO. 5**

Hammond Multi-Wall Bags are *convenient*. They are not only easy to handle, but also easy to pile, easy to open and easy to use!

**FACT
NO. 6**

Hammond Multi-Wall Bags are *attractive*. Bright multi-color printing identifies your company, brand and product to the ultimate consumer—*your customer*.

Just ask the Hammond Man!

HAMMOND BAG & PAPER COMPANY

PAPER MILL AND BAG FACTORY

WELLSBURG, W. VA.

NEW CONSTRUCTION

PROPOSED WORK

Ala., Tuscaloosa—Robins Tire & Rubber Co., Tuscaloosa, is having plans prepared by H. A. Griffith, Jr., Sheffield, for a 1 story, 100x500 ft. and part 2 story, 100x100 ft. tire factory. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$500,000.

Calif., Oakland—Pacific Rubber & Tire Manufacturing Co., 4901 East 12th St., plans to construct an additional wing at its plant and install new equipment. Estimated cost \$1,000,000.

Conn., West Haven—Armstrong Rubber Co., 475 Elm St., plans to construct an addition to its plant, Fletcher-Thompson, 211 State St., Bridgeport, Engr. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$2,000,000.

Ill., Chicago—Bauer & Black, 2500 South Dearborn St., are having plans prepared by Battex & Childs, Engr., 231 South LaSalle St., for 1 and 3 story additional manufacturing buildings at their plant.

Mich., Saginaw—Louis Rose Refining Co., 7177 North Washington St., is having plans prepared for an addition to its refinery. Estimated cost \$150,000.

N. J., Newark—Fiske Bros. Refining Co., 129 Lockwood St., is having plans prepared by Robert Klemm, Archt., 944 Broad St., for a 2 story, 50x175 ft. manufacturing building and warehouse. Estimated cost \$100,000.

Pa., Marcus Hook—General Chemical Co., 40 Rector St., New York, N. Y., plans alterations and additions to laboratory at Baker and Adamson Works, Oscar Fisher, 154 Nassau St., New York, N. Y., Archt. & Engr. Estimated cost \$50,000.

Pa., Ruffsdale—Dillinger Distilleries, Inc., 12 South 12th St., Philadelphia, plans to rebuild 4 story distillery and grain storage buildings recently destroyed by fire. Estimated cost \$100,000.

Tex., Carthage—Chicago Corp. and Tennessee Gas & Transmission Co., Commerce Bldg., Houston, plans to construct a recycling plant. Estimated cost \$2,000,000.

Tex., Houston—Consolidated Chemical Industries, Inc., M. Esperson Bldg., plans to construct a new unit at its plant. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$90,000.

Tex., Orange—Kenso Chemical Products, Inc., 1203 Milby St., Houston, plans to construct two additions to its plant to be used as a galvanizing unit. Estimated cost \$75,000. Also a fireproof pickling and painting plant to cost \$40,000.

Wyo., Cowley—General Petroleum Corp., Cowley, plans to construct a skimming plant and crude oil loading racks and facilities. Estimated cost \$750,000 and \$75,000 respectively.

CONTRACTS AWARDED

Ala., Gadsden—Goodyear Tire & Rubber Co., Gadsden, and 1144 East Market St., Akron, O., has awarded the contract for a tire factory addition to A. K. Adams Co., 542

	Current Projects		Cumulative 1945	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	\$2,000,000	.....	\$2,000,000	\$220,000
Middle Atlantic	250,000	\$7,765,000	4,104,000	9,455,000
South	500,000	18,450,000	540,000	10,160,000
Middle West	100,000	3,650,000	5,775,000	4,421,000
West of Mississippi	2,130,000	29,150,000	26,580,000	40,104,000
Far West	1,825,000	.....	2,700,000	3,620,000
Canada	.....	.....	1,015,000	600,000
Total	.....	\$6,805,000	\$59,015,000	\$42,714,000
				\$68,570,000

Plum St., N. W., Atlanta, Ga. Estimated cost \$1,000,000. Project will be financed by Defense Plant Corp., Washington, D. C.

Ala., Tuscaloosa—B. F. Goodrich Co., 500 S. Main St., Akron, O., has awarded the contract for a synthetic tire plant to Austin Co., 16112 Euclid Ave., Cleveland, O. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost including equipment \$14,000,000.

Pa., Bowdon—Textile Rubber Co., Inc., Bowdon, has awarded the contract for extending plant and equipment to H. W. Richards, Carrollton. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$250,000.

Ind., Hammond—Stauffer Chemical Co., 5801 Indianapolis Blvd., has awarded the contract for the construction of a sulphuric acid plant to Leonard Construction Co., 37 South Wabash Ave., Chicago, Ill. Estimated cost \$650,000.

Minn., Red Wing—S. B. Foot Tanning Co., Red Wing, has awarded the contract for a 1 story addition to its tannery to C. O. Field Co., 2940 Harriet Ave., Minneapolis. Estimated cost \$100,000.

Mich., Detroit—U. S. Rubber Co., 6600 East Jefferson Ave., has awarded the contract for a tire production plant to O. W. Burke Co., 1001 Fisher Bldg. Estimated cost \$3,000,000.

Mo., St. Louis—Mallinckrodt Chemical Works, 3600 North Second St., has awarded the contract for alterations and improvements to its plant to Dickie Construction Co., 317 North 11th St., St. Louis 1. Estimated cost \$50,000.

Mo., St. Louis—Monsanto Chemical Co., 1700 South Second St., has awarded the contract for the construction of a sulphuric acid plant, Unit 7, to Leonard Construction Co., 37 South Wabash Ave., Chicago, Ill. Estimated cost \$700,000.

N. J., Paulsboro—Socony Vacuum Oil Co., Paulsboro, has awarded the contract for a 1 and 2 story lubricating oil pilot plant laboratory building to Skinner, Cook & Babcock, Inc., 60 East 42nd St., New York, N. Y. Estimated cost \$75,000.

N. C., Plymouth—North Carolina Pulp Co., Plymouth, Div. of Kieckhefer Container Co., Camden and Delair, N. J., has awarded the contract for additions to its plant to Charles F. Rohleder, 2134 Cherry St., Philadelphia, Pa. Estimated cost including equipment \$1,000,000.

Pa., Jeannette—Pennsylvania Rubber Co., Jeannette, has awarded the contract for a 1 story addition to its plant to Westmore-

land Construction Co., Jeannette. Estimated cost will exceed \$40,000.

Pa., Pottstown—Firestone Tire & Rubber Co., 1278 South Main St., Akron, O., has awarded the contract for converting former Jacob Aircraft Corp. plant into a tire manufacturing plant to Day & Zimmerman, Inc., Packard Bldg., Philadelphia. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$7,000,000.

Pa., St. Marys—Stackpole Carbon Co., 20 Tannery St., will construct a 1 story, 50x29 ft. glass processing plant. Estimated cost \$50,000.

Pa., Spring Mill (Conshohocken P. O.)—Le Tire & Rubber Co., Spring Mill, has awarded the contract for an addition to its tire manufacturing plant to Stofflet & Tillotson, 204 Eastburn Ave., Philadelphia. Estimated cost \$600,000.

Tenn., Memphis—Buckeye Cotton Oil Co., 2899 Jackson Ave., has awarded the contract for the design and construction of a chemical pulp plant on 4 acre site adjacent to present plant to H. K. Ferguson Co., Hamm Bldg., Cleveland, O. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$2,200,000.

Tex., Freeport—Dow Chemical Co., Freeport, has awarded the contract for an addition to its plant here to Tellepsen Construction Co., 3900 Clay Ave., Houston. Estimated cost \$50,000.

Tex., Houston—Kelley-Springfield Tire Co., 407 North Main St., has awarded the contract for a truck tire manufacturing plant to Brown & Root, Inc., 4300 Calhoun Rd. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$6,150,000.

Tex., Karnack—Monsanto Chemical Co., Karnack, has awarded the contract for increasing the capacity of the ordnance plant here to Esslinger-Misch Co., Marshall and Karnack. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$500,000.

Tex., Orange—E. I. du Pont de Nemours & Co., Inc., 2219 McKinney St., Houston, and Wilmington, Del., will construct a nylon salt plant. Work will be done by force account. Estimated cost \$20,000,000.

Tex., Waco—General Tire & Rubber Co., 1708 E. Market St., Akron, O., has awarded the contract for doubling the capacity of the rubber tire manufacturing plant here to Brown & Root, P. O. Box 3, Houston, Tex. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost \$1,600,000.